ISP Daisy Chain Download User Manual

Version 7.1

Technical Support Line: 1-800-LATTICE or (408) 428-6414
pDS4104 -RM Rev 7.1.1

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Preface

This preface contains sections about the following information:

- Purpose of this user manual
- What is in this user manual
- Where to look for information
- Documentation conventions
- Related documentation

Purpose of this Manual

This manual describes the capabilities and use of the in-system programmable Large Scale Integration (ispLSI®) circuit download software and procedures. It serves as a primary learning guide for downloading JEDEC and VIP files with the configuration setup (.dld, .cdf) files to programmable devices.

Intended for use by design engineers who are knowledgeable in system design, system architectures, and the use of design programs, this manual will guide you through the download process from within a PC Windows® environment.

Scope of this Manual

The following topics are covered in this manual.

- System installation requirements and procedures
- ISP Daisy Chain Download (ispDCD™) software features and design flow
- Configuring multiple device daisy chains
- ispDCD programming setups
- Graphic User Interface (GUI) features and usage
- Managing ispDCD files, including JEDEC and VIP design files
- Setting and editing a User Electronic Signature (UES)
- Device programming using the standard ispDCD interface and the integrated ispVM™ interface
- Turbo downloading
- Generating ATE Vector Files
- Simulating ATE Functions

Where to Look for Information

Chapter 1, "Introduction" – Provides an introduction to the manual and gives the installation procedure for the ISP Daisy Chain Download software.

Chapter 2, "ISP Daisy Chain Download Overview" – Provides an overview of the ispDCD software, including features, design flow, programming setups, and the user interface.

Chapter 3, "Device Programming" – Describes in detail how to perform device programming using the Lattice Semiconductor ISP Daisy Chain Download system software tool.

Manual Conventions

The following table lists the conventions used in this manual.

Convention	Definition and Usage
Italics	Italicized text represents variable input. For example: *design*.dld This means you must replace *design* with the file name that you used for all the files relevant to your design. Valuable information may be italicized for emphasis. Book titles appear in italics. The beginning of a procedure also appears in italics. For example: *To create a new configuration:*
Bold	Valuable information may be boldfaced for emphasis. Commands are shown in boldface. For example: 1. Select **Command** ⇒ **Turbo Download** ⇒ **Build** from the ISP Daisy Chain Download menu.
`Courier Font`	Monospaced (Courier) font indicates file and directory names and text that the system displays. For example: The `C:\DCD\EXE` subdirectory contains...
`Bold Courier`	Bold Courier font indicates text you type in response to system prompts. For example: C:> **`dld <path_name><file_name>`**
|...|	Vertical bars indicate options that are mutually exclusive; you can select only one. For example: **`OK|Cancel`**
“Quotes”	Titles of chapters or sections in chapters in this reference manual are shown in quotation marks. For example: See Chapter 2, “ISP Daisy Chain Download Overview.”
✍ ***NOTE***	Indicates a special note.
▲ **CAUTION**	**Indicates a situation that could cause loss of data or other problems.**
❖ **TIP**	Indicates a special hint that makes using the software easier.
⇒	Indicates a menu option leading to a submenu option. For example: **Command** ⇒ **Turbo Download** ⇒ **Build**

Related Documentation

The following is a list of manuals that provide information on related Lattice Semiconductor products:

- ispEXPERT Compiler User Manual
- ispEXPERT Compiler Getting Started Manual
- Lattice Semiconductor ISP Encyclopedia
- ispEXPERT System User Manual
- ispEXPERT System Getting Started Manual

Chapter 1 *Introduction*

This chapter introduces the ISP Daisy Chain Download (ispDCD) system hardware and software requirements, installation procedure, and describes how to get help.

System Requirements

To run the ispDCD software as a stand-alone application, you need the following hardware:

- IBM® PC-AT™ 486-compatible (or higher)
- 1 serial port
- 1 parallel port
- 8 MB RAM
- Approximately 2.4 MB of disk space
- EGA/VGA display (VGA is recommended)
- CD-ROM drive
- Microsoft Windows-compatible mouse and mouse driver

If you install ispDCD as a part of the ispEXPERT Compiler software package, see the *ispEXPERT Compiler Getting Started Manual* for the system requirements.

If you install ispDCD as a part of the ispEXPERT System software package, see the *ispEXPERT System Getting Started Manual* for the system requirements.

Installation Procedure

The ISP Daisy Chain Download (ispDCD) software can be installed from CD or the Lattice website in one of four ways:

- as a part of the ispEXPERT Compiler installation
- as a part of the ispEXPERT System installation
- as a part of the ispGDX installation
- as a stand-alone installation

> ***NOTE*** If you plan to replace an older version of ISP software with a newer version, it is recommended that you first uninstall the older version of software before continuing.

Installing ispDCD from ispEXPERT Compiler, ispEXPERT System, or ispGDX

If you choose to install the ispDCD software during installation of the ispEXPERT Compiler, ispEXPERT System, or ispGDX software packages, refer to the *ispEXPERT Compiler Getting Started Manual* or the *ispEXPERT System Getting Started Manual* for information. During the installation process, the ispDCD software files are placed into the locations shown below.

Installing from ispEXPERT Compiler or ispEXPERT System:

`<drive>:\isptools\ispcomp\bin`

Installing from ispGDX:

`<drive>:\isptools\ispgdx\bin`

Installing ispDCD as a Stand-Alone Application

The installation setup program requires that Microsoft Windows 95, Windows 98, or Windows NT 4.0 be installed on your system. The following procedure automatically installs the ISP Daisy Chain Download (ispDCD) software under the Microsoft Windows environment.

To install the ISP Daisy Chain Download software:

1. When installing from a CD, first insert the Lattice Semiconductor Corporation CD-ROM into the CD drive and select **Run...** from the Start menu. Enter the following command in the Run dialog box:

   `<cd_drive>:setup`

   When installing from the Lattice website, double-click the `setup.exe` file icon to begin the installation process.

   The installation program checks for the Windows O/S; if Windows NT is detected, the program installs the download driver (`isp.sys`).

> **NOTE** System Administrator privileges are required to install the download driver.

2. After you have accepted the software license agreement and chosen the destination for your files, the installation software displays the Lattice ISP software already installed on your system. Click **Next**.
3. In the Product Options dialog box (Figure 1-1), select the ISP Daisy Chain Download option and deselect all other options. Click **Next**.

Figure 1-1. Product Options Dialog Box

4. Follow the instructions that appear on your screen to complete the installation. When installed as a stand-alone application, the ispDCD files are placed by default into the following directory:

   `<drive>:\isptools\ispdcd`

Software Support

In most cases, this manual will answer your questions. However, if you have further questions about using the ISP Daisy Chain Download software, contact Lattice Semiconductor Corporation for assistance.

Technical Support

Before contacting Lattice Semiconductor Technical Support, take a moment to review the following information for possible answers or solutions.

1. Consult the Lattice Semiconductor documentation that you received with your software; it will answer most of your questions.
2. Ensure that the hardware meets the minimum system requirements listed under **"System Requirements" on page 10**.
3. Verify that your system hardware and peripherals are set up according to their respective documentation and that all cable connections are secure.
4. Verify that the proper installation of Microsoft Windows is running in enhanced mode.

Customer Hotline

If you have any questions or problems with this software, please call the Lattice Semiconductor Applications Hotline at **1-800-LATTICE** (1-800-528-8423) or (408) 428-6414. The hotline is available Monday through Friday from 8:00 AM to 5:00 PM, Pacific Time. Or, send e-mail to applications@latticesemi.com.

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	Fax	(408) 944-8450	
	Bulletin Board System	(408) 428-6417	
	E-mail	applications@latticesemi.com	
	World Wide Web	http://www.latticesemi.com	
	Downloads	http://www.latticesemi.com/ftp	
GAL/ispGAL/ispGDS Applications Support	Telephone Hotline	1-888-ISP-PLDS	(503) 268-8000
	Fax	(503) 268-8037	
	Bulletin Board System	(503) 693-0215	
	E-mail	gal@latticesemi.com	
	World Wide Web	http://www.latticesemi.com	
	Downloads	http://www.latticesemi.com/ftp	

Information Need	Customer Resource	USA & Canada	Other Locations
Literature	Telephone Hotline	1-888-ISP-PLDS	(503) 268-8000
	Fax	(503) 681-3037	
	E-mail	gal@latticesemi.com	
	World Wide Web	http://www.latticesemi.com	
	Downloads	http://www.latticesemi.com/ftp	

Chapter 2 *ISP Daisy Chain Download Overview*

The ISP Daisy Chain Download (ispDCD) software is a comprehensive design download package that provides an efficient method of programming ISP devices using JEDEC and VMF files generated from any compatible software tool. This complete device programming tool allows you to quickly and easily download your designs to your devices.

Software Features

The ispDCD software package offers the following features:

- Support for the Microsoft Windows 95, 98, and NT 4.0 design environments
- Multivendor support using the ispVM feature
- JEDEC file transfer via a download cable directly from your system
- JEDEC file transfer to a third-party programmer
- Detection and identification of as many as 200 devices at once
- Easy set-up menus for multiple ports
- Simple device configuration menus
- Single ISP device programming
- Multiple ISP device daisy chain programming
- Mixed chain downloading including JTAG device recognition
- Turbo downloading of daisy-chained devices
- ispSTREAM™ bit building, saving and loading
- Serial Vector Format (SVF) file support
- Virtual Machine Format (VMF) file support
- Boundary Scan Description Language (BSDL) recognition
- UES (User Electronic Signature) reading and coding
- ATE vector file generation and simulation support
- Online help

Software Design Flow

The ISP Daisy Chain Download software with the integrated ispVM tool uses any JEDEC file or VMF file to program, in-system (on the board), a device or multiple devices. The “board” can be a one-device programmer or it can be inside your CPU on the board itself, which requires no external programmer. ISP Daisy Chain Download also recognizes mixed chains with non-LSC JTAG compatible devices.

Once the cables are properly connected, the ISP Daisy Chain Download software can identify the number of devices you wish to program and accept your instructions. A diagram of the ispDCD functional design flow is shown in Figure 2-1.

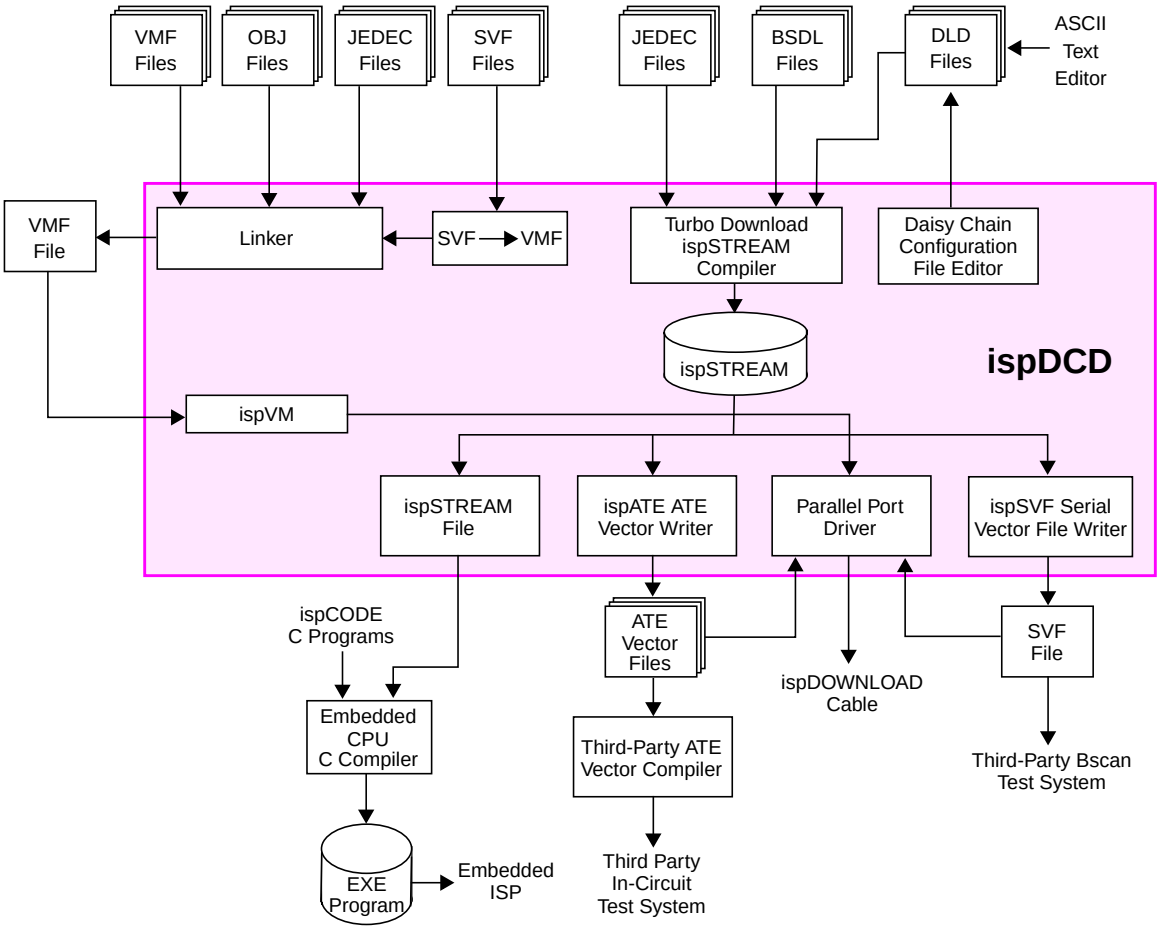

Figure 2-1. ispDCD Functional Flow

Programming Features

The ISP Daisy Chain Download software allows you to program your designs onto ISP (in-system programmable) devices. In-system (on-board) programming is particularly advantageous because it eliminates the necessity of mounting, plugging, and socketing devices on a device programmer. This minimizes the risk of bent or broken pins that can occur when handling devices.

Devices can be re-programmed many times, depending on your system needs. In addition, a security feature can be set so that the device cannot be read once it is programmed.

The ISP Daisy Chain Download software is easy to use, fast, and comprehensive. One screen provides all you need to download designs to your devices.

From the main window, you can quickly configure the port setup by specifying such parameters as device type, the JEDEC or VMF file you want to load onto each particular device, and the mode of operation that you want to perform for each device. Once you supply the setup information, you can check your setup to identify any errors and resolve them prior to downloading the design files onto the appropriate devices.

The integrated ispVM tool provides an open programming application that allows programming of all ISP devices through the use of VMF-format files. Since VMF files contain the fusemap data plus the algorithm needed to program devices, they are faster and more universal than the standard JEDEC file format.

With the ispVM tool you can:

- Build and save VMF files from JEDEC files and download the VMF files directly from your system
- Convert SVF files to VMF files and download them directly from your system

The ispVM is easily accessed as a menu item from the standard ispDCD window and provides the same look, usability, and design flow as the standard ispDCD system.

Programming Chains

Figure 2-2 provides a typical block diagram of multiple ISP devices cascaded together. The figure shows various ISP features, such as device identification, command shifting, device bypass, and command execution.

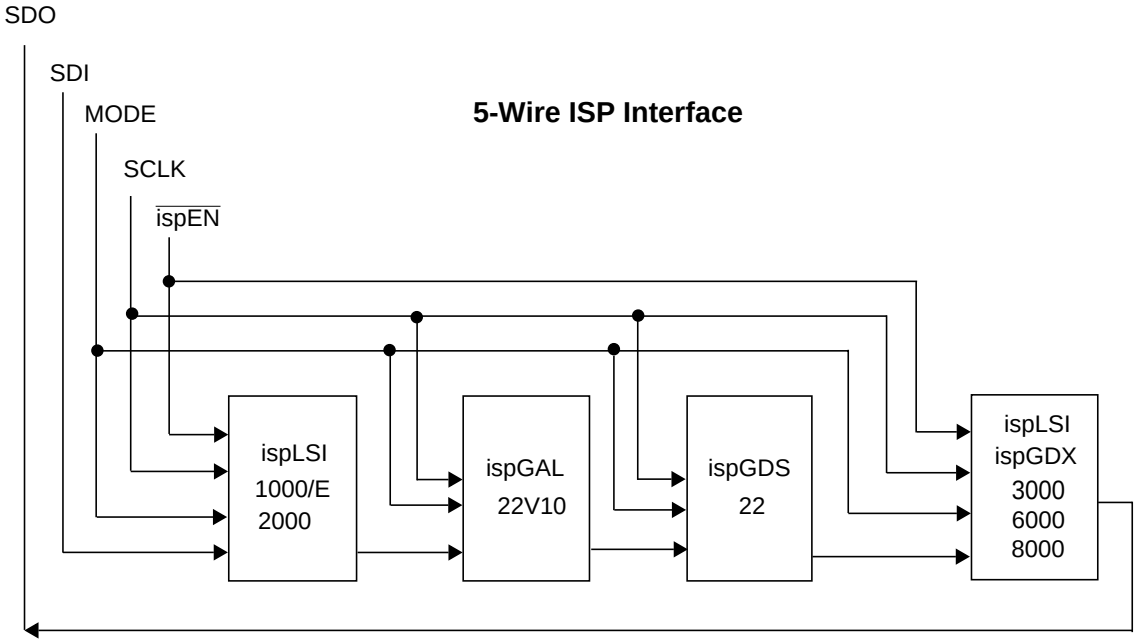

Figure 2-2. Multiple ISP Interface

Figure 2-3 provides a typical block diagram of multiple ispLSI devices connected to the 5-wire ispJTAG interface.

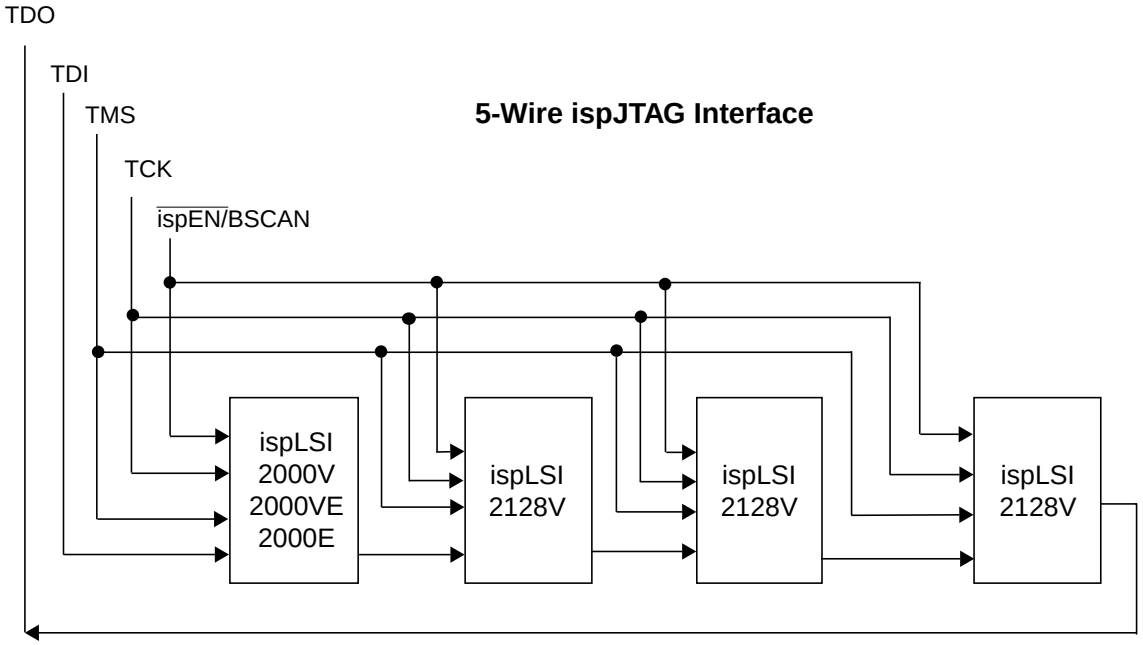

Figure 2-3. Multiple ispJTAG Interface

Figure 2-4 shows a typical block diagram of multiple ispLSI devices connected to the 4-wire ispJTAG interface.

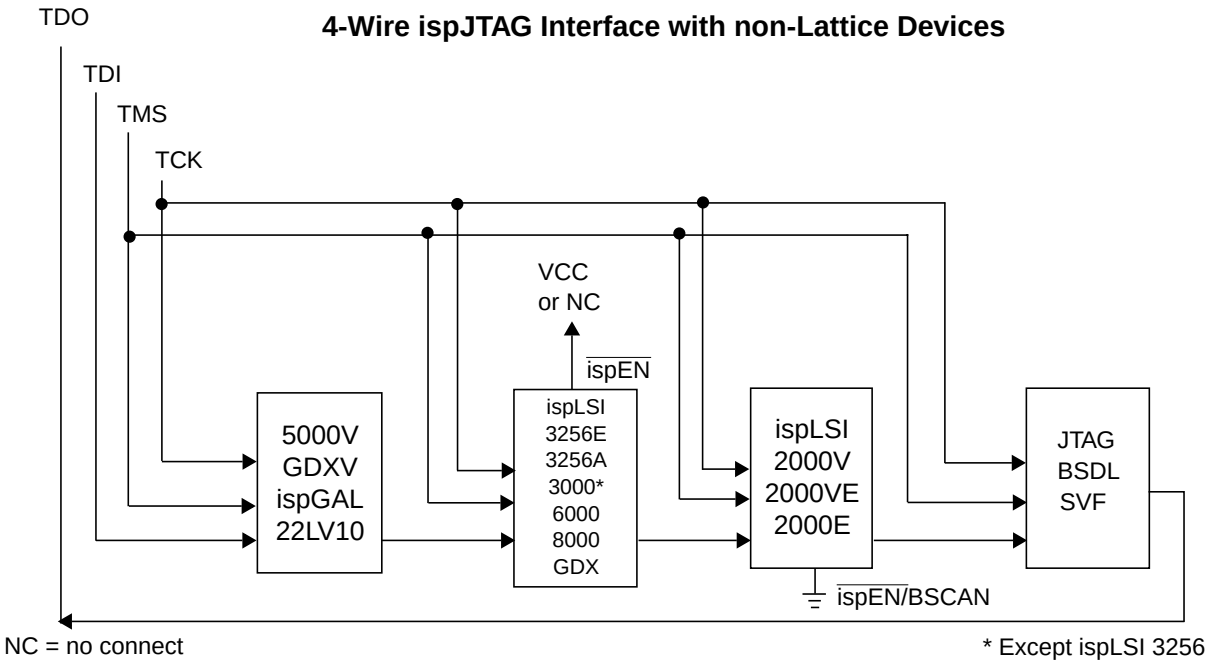

Figure 2-4. ispJTAG Chain Interface

Figure 2-5 illustrates a typical block diagram of multiple ispLSI devices connected to the 5-wire (ISP and ispJTAG) mixed interface. The ispDOWNLOAD Cable v2.0 is required for the mixed interface.

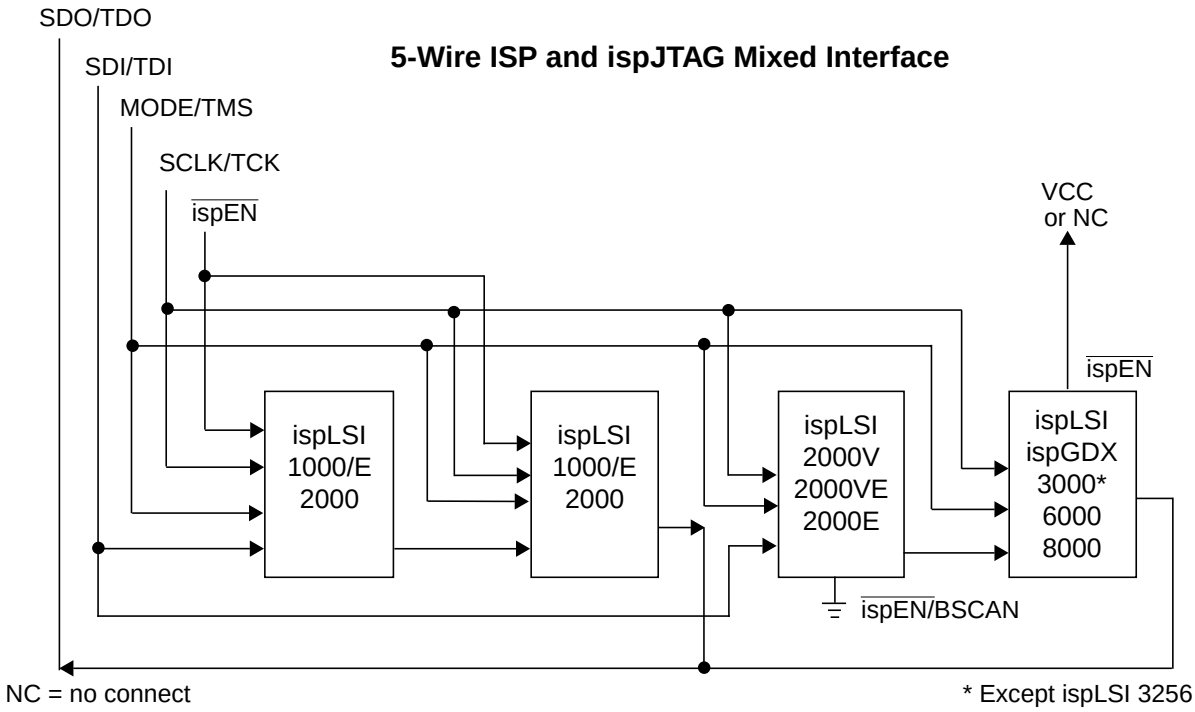

Figure 2-5. 5-Wire ISP and ispJTAG Mixed Interface

Device Types

ISP devices can be divided into the following types:

- **JTAG** – Devices with a known Instruction Register length. JTAG devices are always put into the bypass mode of operation (NOP).
- **BSDL** – Devices with a given BSDL file. BSDL devices are always put into the bypass mode of operation by looking for the instruction register bit length in the BSDL file.
- **SVF** – Devices with a given SVF file. All Lattice devices are operated on first because this device is put in bypass mode. The instruction register bit length of the device is obtained from the user-provided SVF file. After specified operations on Lattice devices have completed, each SVF device is processed in sequence.

Security Feature

The ispLSI and ispGAL22V10 devices contain a security bit that enables or disables program verification. If the security bit is enabled, the device program cannot be read, thus preventing unauthorized access to your design.

When you use the Lattice ispEXPERT Compiler software, you can turn on the Security check box in the Device Options section of the Device Selection dialog box. Alternatively, you can control the security bit through the SECURITY Device Control Option in a Parameter File.

The security bit can also be set when programming devices by selecting one of the appropriate operation mode options, such as Program, Verify, and Secure.

The security feature defaults to SECURITY OFF. For additional information on the security feature, see the ***ispEXPERT Compiler User Manual*** for details on how to set the security bit.

ISP Download Support

Before you can program devices using the ISP Daisy Chain Download software, you must first have the following:

- the proper programming setup
- a JEDEC-format ASCII file or a VMF-format file to download onto a programmable device.

Programming Setups

There are four primary hardware setups that can be used to program Lattice Semiconductor ISP devices:

- In-system (without removing the devices from the circuit board)
- Using the isp Engineering Kit Model 100
- Using a third-party programmer
- Using automatic test equipment (ATE)

Using a PC and the isp Engineering Kit Model 100

One of the setups that can be used to program devices is a PC along with the isp Engineering Kit Model 100. The PC's parallel port and the kit hardware provide the physical interface needed to download your design files using the ispDCD software. The isp Engineering Kit Model 100 contains the following:

- Universal Programming Module
- 25-pin parallel port adapter
- ispDOWNLOAD cable
- System cable
- Power supply converter (110VAC/9VDC @ 200 mA) – North America and Asia only
- *isp Engineering Kit Hardware Assembly Manual*, *Model 100*

To program ISP devices directly on the universal programming module (Figure 2-6), a socket adapter (purchased separately) is required. A unique socket adapter board is available for each package type and includes an ISP sample device.

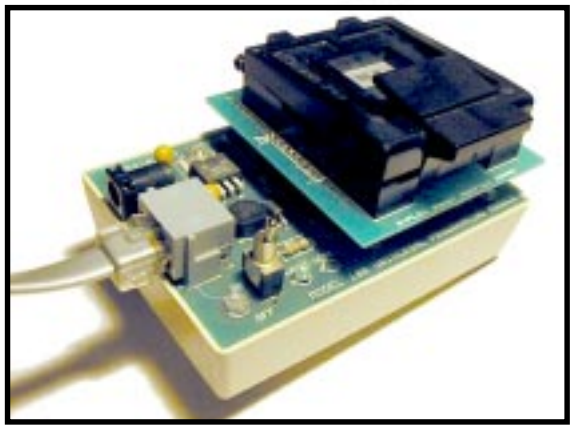

Figure 2-6. Universal Programming Module with Socket Adapter

Table 2-1 shows a partial list of the socket adapters that are now available from Lattice Semiconductor Corporation.

A 5- to 3-volt converter, purchased separately, is required to program 3.3-volt ispLSI devices. To determine if a device requires a converter, refer to Table 2-1.

A diagram of a setup using a PC and the isp Engineering Kit Model 100 is shown in Figure 2-7.

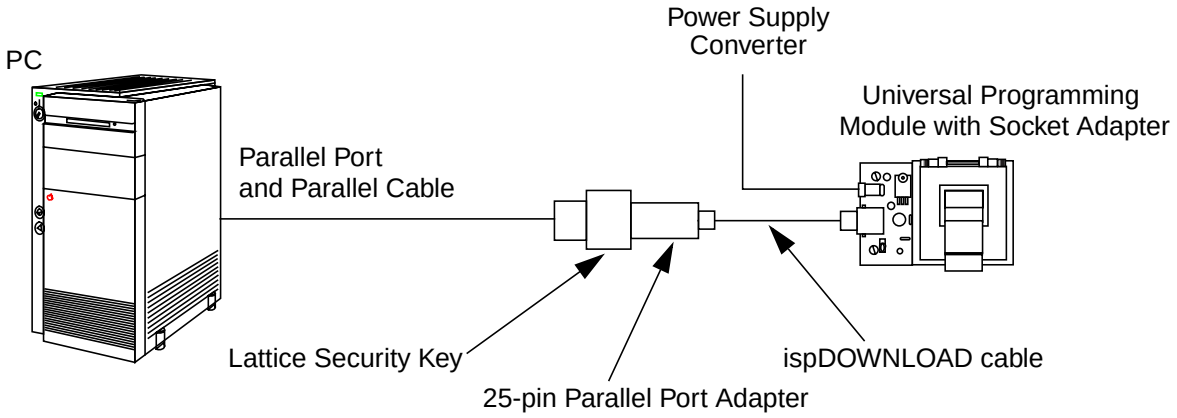

Figure 2-7. Sample Programming Setup

Table 2-1. Socket Adapter Boards

Socket Adapter Part Number	Pins	Device Type	Package Type
pDS4102-J44	44	ispLSI 2032 ispLSI 2032LV/V*	PLCC
pDS4102-T44	44	ispLSI 1016E ispLSI 2032 ispLSI 2032LV/V*	TQFP
pDS4102-J68	68	ispLSI 1024	PLCC
pDS4102-J84	84	ispLSI 1032	PLCC
pDS4102-T100	100	ispLSI 1032 ispLSI 1032E ispLSI 2064	TQFP
pDS4102-Q120	120	ispLSI 1048	PQFP
pDS4102-Q128	128	ispLSI 1048C ispLSI 1048E ispLSI 2096	PQFP
pDS4102-T176	176	ispLSI 2128	TQFP
pDS4102-M160	160	ispLSI 2128 ispLSI 3256/A	MQFP
pDS4102-T176/2128V	176	ispLSI 2128V*	TQFP
pDS4102-J84/2064V	84	ispLSI 2128V*	PLCC
pDS4102-T100/2128V	100	ispLSI 2128V*	TQFP
pDS4102-M208	208	ispLSI 6192	MQFP
pDS4102-M240	240	ispLSI 3192	MQFP
pDS4102-M304	304	ispLSI 3256E	MQFP
pDS4102-B272/5256V	272	ispLSI 5256V* ispLSI 5384V*	BGA
pDS4102-B492/8840V	492	ispLSI 8840V*	BGA

* The 5- to 3-volt converter must be purchased separately and used in conjunction with the socket adapter to program these 3.3-volt devices.

Ordering the isp Engineering Kit Model 100 or 5- to 3-Volt Converter

To order the isp engineering kit, socket adapters, or 5- to 3-volt converter, contact a Lattice Semiconductor sales representative.

The part numbers are as follows:

isp Engineering Kit Model 100	5- to 3-Volt Converter
pDS4102-PM (North America and Asia) pDS4102E-PM (Europe)	pDS4102-3/5ADP

Using Third-Party Programmers

Third-party programming setups may be used to download designs to your devices. Refer to the documentation for the specific programmer that you are using.

Table 2-2 lists the LaticeSC-qualified, third-party device programmers for the ISP families.

Table 2-2. Lattice-Qualified Programmers

Vendor	Model
Advin Systems	Pilot GL/GCE, Pilot U40/U84/U168/U256
BP Microsystems	CP/PLD-1128, BP-1200
Data I/O	2900, 3900, ChipLab, Unisite 40, Unisite 48, Autosite
Logical Devices	Allpro 32/40, Allpro 88
Stag	ZL30/A/B, System 3000, Quasar 1040/1084, Eclipse
System General	Turpro-1/FX, Turpro-1

NOTE High pin-count socket adapters are available from Emulation Technology.

For a complete listing of certified third-party PLD programmers that support the ISP families, refer to the *Third Party Programming Tools Guide*. You can obtain this Data Sheet from the following sources:

- The Lattice Semiconductor Literature Department (1-800-327-8425)
- The Lattice Semiconductor world wide web site (http://www.latticesemi.com)

Using Automatic Test Equipment (ATE)

Using ATE setups to program and verify ISP devices improves product testability, and avoids the overhead and time penalties associated with stand-alone, third-party programmers.

With the ispDCD software, you can use JEDEC files to generate test vectors to program devices via an ATE setup. For information on ATE setups, refer to the vendor documentation for the specific ATE being used. For information on generating ATE vectors, refer to **Chapter 3, "Device Programming."**

Table 2-3 lists the vendor and equipment models supported by Lattice Semiconductor.

Table 2-3. Lattice-Supported ATE

Company	Model
Hewlett Packard	All testors, including: Models 3060, 3065, 3070, 3073
GenRad	GR228X/e Series
Marconi	4200 Series
Teradyne	Z1800 Series and Z8000 Series NOTE: Vector Processor Option must be installed.

User Interface

The ispDCD user interface provides the following two main windows:

- ISP Daisy Chain Download window
- ispVM window

You can switch from one window to the other using **View** ⇒ **ispVM** and **View** ⇒ **ispDCD**. The ispDCD window is decribed below. For information on the ispVM window, refer to **"ispVM Window" on page 33**.

ISP Daisy Chain Download Window

When you invoke the ispDCD tool, the ISP Daisy Chain Download main window appears (Figure 2-8). You can use the pull-down menus or the tool bar icons to perform the various functions needed to download JEDEC files to the devices in the daisy chain.

Incorporated into the main window is the Messages window that displays all system messages and can be resized, but not closed.

Figure 2-8. ISP Daisy Chain Download Window

Menu Bar and Toolbar

The following tables summarize the ispDCD menu bar commands and associated toolbar icons.

The **File** menu contains the commands shown in Table 2-4.

Table 2-4. File Menu Commands

Command	Icon	Description
New		Creates a new configuration setup.
Open		Opens a previously saved configuration setup.
Save		Saves a named configuration setup.
Recent File	N/A	Displays a list of recently accessed files.
Save As	N/A	Names and saves a configuration setup.
Exit	N/A	Exits the ISP Daisy Chain Download program.

The **Edit** menu contains the commands shown in Table 2-5.

Table 2-5. Edit Menu Commands

Command	Description
Set Operations ⇒	Lists the available operation modes for each file, which can then be selected. Although some operation modes are only available for specific configurations, they include the following: **Program and Verify** Performs a download of the design pattern, then verifies the chip program (device pattern) with the original .jed file to ensure the device was programmed correctly. The file name must be specified. This is the default mode of operation. **Program, Verify and Secure** Performs a download of the design pattern, verifies the chip program (device pattern) with the original .jed file to ensure the device was programmed correctly, and then sets the security bit so that the device cannot be read. The file name must be specified.

Table 2-5. Edit Menu Commands (Continued)

Command	Description
Set Operations ⇒ (Continued)	**Checksum** Verifies check sum value of the chip and sends the information to the Status field for the corresponding device. **Read and Save** Reads the chip program and writes it to the specified JEDEC file. **Erase** Erases the chip program and the security fuse for the device you specify. **No Operation** Indicates that no operation will be performed for that device.
Clear File Names	Clears all displayed file names and instruction bit length of the devices.
Set Chain Type ⇒	Lists the available daisy chain download configurations, which can then be selected. Available chain types include the following: **5-Wire ISP Chain** Sets the daisy chain download configuration for 5-wire ISP chain devices. **4-Wire JTAG Chain** Sets the daisy chain download configuration for 4-wire JTAG chain devices.
Set Flag Type ⇒	Lists the available flag types, which can then be selected. Available flag types are: **Hexadecimal** Sets the flag type to hexadecimal format. **ASCII** Sets the flag type to ASCII format.

The **Configuration** menu contains the commands shown in Table 2-6.

Table 2-6. Configuration Menu Commands

Command	Icon	Description
Port Assignment	N/A	Sets the parallel port(s) for the download configuration. The ISP Daisy Chain Download software can detect the default port assignment if you have the cables connected properly when you start the program. Use this option to *reset* the port.
Scan Board		Scans the board and detects the configuration setup of an ISP chain or an ispJTAG chain.
Scan Mixed Chain		Scans the board and detects the configuration setup of both an ISP chain and an ispJTAG chain on the same board.

The **View** menu contains the commands shown in Table 2-7.

Table 2-7. View Menu Commands

Command	Icon	Description
ispVM	N/A	Displays the ispVM window.
ispDCD	N/A	Displays the ispDCD window.

The **Command** menu enables you to verify or download a configuration using the commands shown in Table 2-8.

Table 2-8. Command Menu Commands

Command	Icon	Description
Check Configuration Setup		Verifies your setup once you set up the configuration properly. It is recommended that you run the **Check Configuration Setup** operation prior to downloading to ensure that your JEDEC device files are loading onto the correct devices. This operation is optional.
Board Diagnostic		Performs a diagnostic on the daisy chain configuration in your .isp or .dld file (if the configuration setup window is not open and you choose this feature, the Board Diagnostic window will appear and allow you to choose a new .dld file, open a .dld file, or load an .isp file.

Table 2-8. Command Menu Commands (Continued)

Command	Icon	Description
Run Operation in Sequential Mode		Executes the non-turbo downloading procedure. Builds the turbo ispSTREAM™ automatically if it has not been built. Your design files are programmed onto the devices as specified by the device type, JEDEC file attached, and operation. If the Read and Save or Checksum modes of operation are required, select sequential mode downloading. Otherwise, select turbo downloading. For more information about daisy-chaining your devices, see the *ISP Encyclopedia.*
Run ISP Part of a Mixed Chain		Processes only the ISP part of the mixed chain and ignores the entire ispJTAG part of the mixed chain.
Turbo Download ⇒ Build		Prepares the ISP bit stream for downloading. Builds the ispSTREAM on the daisy-chained devices according to the current device configuration setup.
Turbo Download ⇒ Verify		Verifies the current ispSTREAM against that of the devices. This option can be used after you build the ispSTREAM by selecting either the Program and Verify or the Verify mode of operation.
Turbo Download ⇒ Run Turbo Download		Checks the configuration setup file, then downloads the ispSTREAM to the devices. This feature also builds the ispSTREAM automatically if it has not yet been built.
Turbo Download ⇒ Save ISP File		Saves a built ispSTREAM file to any directory.
Turbo Download ⇒ Load ISP File		Loads a previously saved ispSTREAM file in preparation for device programming. Once you load the ISP bit stream file, you can perform a download without having to build the bit stream again.

Table 2-8. Command Menu Commands (Continued)

Command	Icon	Description
Edit File UES ⇒		Lists the character types that can be programmed for your user electronic signature (UES) using the Windows version of the ispDCD software. Character type selections are the following: **Hexadecimal** Selects the hexadecimal character type for programming your UES. **ASCII** Selects the ASCII character type for programming your UES.
Display Board UES ⇒		Lists the formats in which board UES values can be displayed. Selectable formats are: **Hexadecimal** Scans the board, returns the UES values of all devices in the chain, and displays them in hexadecimal format. **ASCII** Scans the board, returns the UES values of all devices in the chain, and displays them in ASCII format.
Display Mixed Chain UES ⇒		Lists the formats in which mixed chain UES values can be displayed. Selectable formats are: **Hexadecimal** Displays the ispJTAG chain UES of a mixed chain in hexadecimal format. **ASCII** Displays the ispJTAG chain UES of a mixed chain in ASCII format.
Generate ATE Vectors		Generates the test vector files that are used to program and verify ISP devices with automatic test equipment (ATE).
Simulate ATE Testing		Simulates ATE functions. By simulating the test vector files, you ensure that the test vector files will properly download onto the ISP devices.
Generate SVF Files		Builds single-device SVF files for a device or Turbo SVF file for the entire chain of devices.

Table 2-8. Command Menu Commands (Continued)

Command	Icon	Description
Process SVF		Processes SVF files. This function can only be used to simulate Lattice Turbo SVF files.

The **Help** menu contains the commands shown in Table 2-9:

Table 2-9. Help Menu Options

Command	Icon	Description
Help Topics		Provides online help for the Daisy Chain Download software, including a software introduction and command references.
About ispDCD	N/A	This dialog box provides name, version, and copyright information for the ISP Daisy Chain Download software.

ispVM Window

The ispVM main window (Figure 2-9) is very similar in layout to the ISP Daisy Chain Download main window, but it provides the specific pull-down menus and tool bar icons required to download VMF files to the daisy-chained devices.

The ispVM window is accessed from the ISP Daisy Chain Download window menu bar (**View** ⇒ **ispVM**).

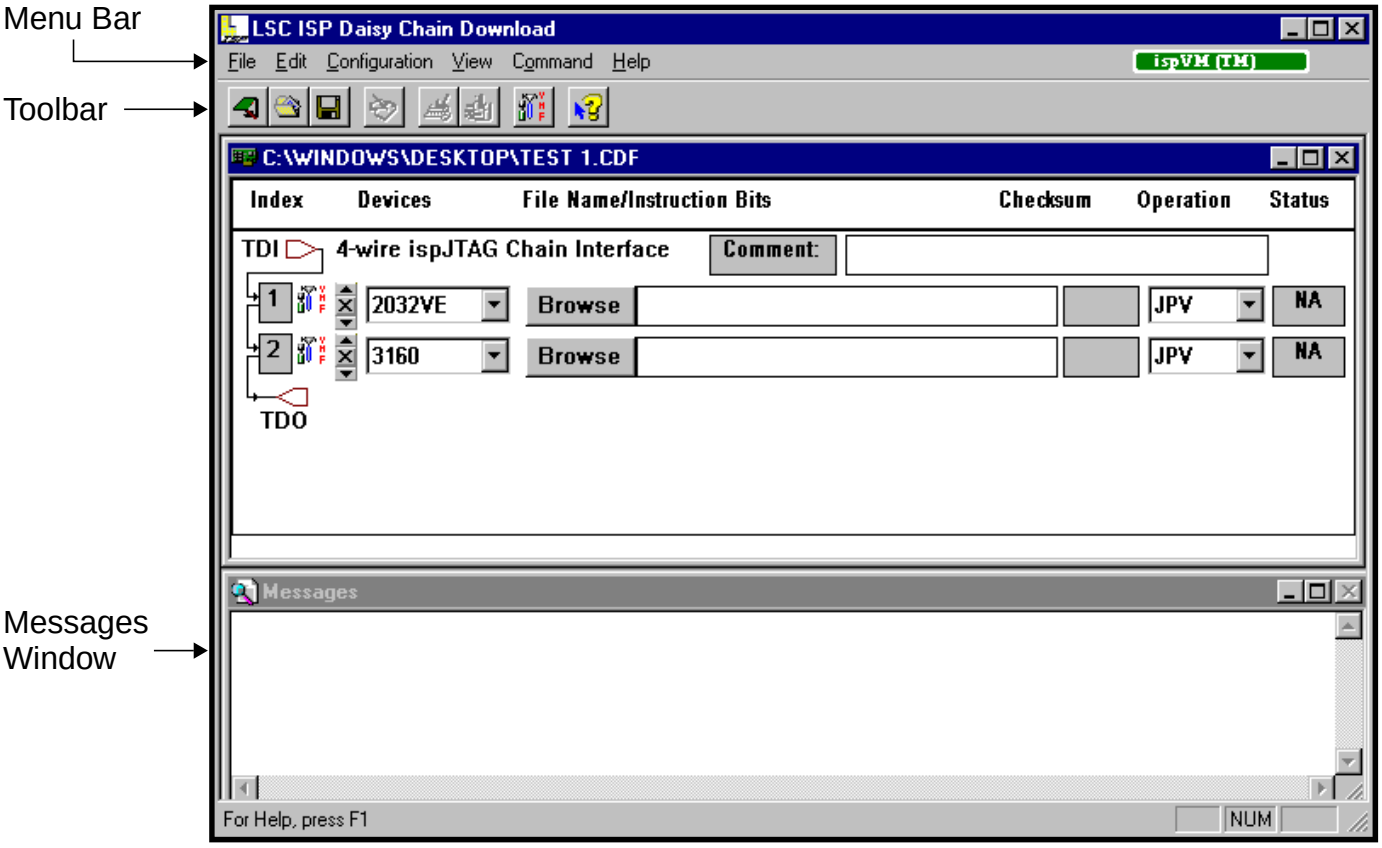

Figure 2-9. ispVM Window

Menu Bar and Toolbar

The following tables summarize the ispVM menu bar commands and associated toolbar icons.

The **File** menu contains the commands shown in Table 2-10.

Table 2-10. File Menu Commands

Command	Icon	Description
New		Creates a new configuration setup.
Open		Opens a previously saved configuration setup.

Table 2-10. File Menu Commands (Continued)

Command	Icon	Description
Save		Saves a named configuration setup.
Recent File	N/A	Displays a list of recently accessed files.
Save As	N/A	Names and saves a configuration setup.
Exit	N/A	Exits the ISP Daisy Chain Download program.

The **Edit** menu contains the commands shown in Table 2-11.

Table 2-11. Edit Menu Commands

Command	Icon	Description
Set Operations ⇒	N/A	Lists the available operation modes for each file, which can then be selected. Although some operation modes are only available for specific configurations, they include the following: **JTAG Program and Verify** Performs a download of the design pattern, then verifies the chip program (device pattern) with the original .jed file to ensure the device was programmed correctly. The file name must be specified. This is the default mode of operation. **JTAG Program, Verify and Secure** Performs a download of the design pattern, verifies the chip program (device pattern) with the original .jed file to ensure the device was programmed correctly, and then sets the security bit so that the device cannot be read. The file name must be specified. **JTAG Verify** Verifies the chip program (device pattern) with the original .jed file to ensure the JTAG device was programmed correctly. **JTAG Erase** Erases the chip program and the security fuse for the device you specify. **JTAG No Operation** Indicates that no operation will be performed for that device.

Table 2-11. Edit Menu Commands (Continued)

Command	Icon	Description
Clear File Names	N/A	Clears all displayed file names and the instruction bit length of all devices.
Set Flag Type ⇒	N/A	Lists the available flag types, which can then be selected. Available flag types are: **Hexadecimal** Sets the flag type to hexadecimal format. **ASCII** Sets the flag type to ASCII format.
View Report		Displays a report file after device operations have completed. The report file consists of an ASCII text file that summarizes the operations performed and the results.

The **Configuration** menu contains the commands shown in Table 2-12.

Table 2-12. Configuration Menu Commands

Command	Icon	Description
Port Assignment	N/A	When selected, the Port Assignment dialog box appears, which allows you to set the parallel port(s) for the download configuration. The software detects the default port assignment when you start the program with the cables connected properly. Use this option to reset the port.

The **View** menu contains the commands shown in Table 2-13.

Table 2-13. View Menu Commands

Command	Icon	Description
ispVM	N/A	Displays the ispVM window.
ispDCD	N/A	Displays the ispDCD window.

The **Command** menu contains the commands shown in Table 2-14.

Table 2-14. Command Menu Commands

Command	Icon	Description
Check Configuration Setup		Verifies your configuration setup. It is best to run the **Check Configuration Setup** operation before you download to ensure that your VMF device files are loading onto the correct devices.
Run Operation		Downloads your design files onto the chained devices, one device at a time, as specified (for example: device type, VMF file attached, and operation).
Build VMF File		When selected, the Build *.VMF dialog box appears that allows you to build VMF files from JEDEC files or SVF files.

The **Help** menu contains the commands shown in Table 2-15.

Table 2-15. Help Menu Options

Command	Icon	Description
Help Topics	N/A	Provides online help for the ispVM software, including a software introduction and command references.
About ispVM	N/A	This dialog box provides name, version, copyright information, and system resource information for the ispVM software.

Chapter 3 *Device Programming*

In order to program devices, you need a file containing the design to download to your devices, and the hardware to transfer the design file. For information on programming hardware, refer to **Chapter 2, "ISP Daisy Chain Download Overview"** and the appropriate third-party or ATE documentation as required.

This chapter contains information on the file types and the specific procedures used to program ISP and ispJTAG devices.

Programming ISP Devices

Lattice Semiconductor high-density ISP devices have an advanced feature that allows you to program and reprogram in-system without removing your devices from the printed circuit board. This feature eliminates the need for sockets and avoids the common reliability problems associated with sockets. In-system programming can be done with an ispDOWNLOAD cable connected between the system and the board.

Using Windows on the PC

A convenient way to program ISP devices in-system (on the board) is to use a PC (Windows environment) and the isp Engineering Kit Model 100. Another method is to implement the ISP algorithm for your system and the ISP Daisy Chain Download software. This manual describes the method of programming that uses a PC running Windows 95/98. For information on using other setups, refer to the *ISP Encyclopedia.*

Programming File Formats

The primary file formats that are used to program ISP and ispJTAG devices are the JEDEC, ISP bit stream, ATE Vector, SVF, and VMF formats.

JEDEC (.jed) are ASCII files produced by a compiler, such as the ispEXPERT Compiler by Lattice Semiconductor, and contain data that specifies the fusemap for the device to be programmed.

ISP Bit Stream (.isp) files combine one or more JEDEC files into a serial data stream that allows for much faster transfer of programming data to the devices.

ATE Vector files can be generated from JEDEC files, using the ispDCD tool, and used to program devices using automatic test equipment.

SVF (.svf) files store data for programming one or more fixed algorithm devices in ATE-type programming environments. SVF files can be built from JEDEC files and used themselves to program devices, or used to build VMF files to program devices.

VMF (.vmf) files are produced by a compiler and contain both the fusemap and the algorithm needed to program devices; therefore, VMF files are faster and more universal than JEDEC files for programming devices. In addition to using existing VMF files, new VMF files can also be built from JEDEC or SVF files using the ispVM feature.

For many file formats, the standard ispDCD tool is used to program devices. However, in order to program devices using VMF design files, or convert SVF files to VMF design files, you must use the integrated ispVM tool.

Using the ispDCD Tool

The following tasks can be accomplished using the standard ispDCD tool:

- Create or load existing configuration (.dld) files
- Download JEDEC files directly to your devices
- Convert one or more JEDEC files to an ISP bit stream for downloading
- Convert the JEDEC file to ATE Vectors, which are then used with automatic test equipment to program the devices
- For ispJTAG devices only: Convert the JEDEC files to SVF files for downloading

To download designs using the ispDCD window, refer to **“Downloading Using ispDCD” on page 39**.

Using the ispVM Tool

The following tasks can be accomplished using the integrated ispVM tool:

- Create or load existing configuration (.cdf) files
- Convert JEDEC files to VMF files for downloading
- Convert SVF files to VMF files for downloading

To download designs using the ispVM window, refer to **“Downloading Using ispVM” on page 63**.

For additional information about the ISP interface, programming multiple ISP devices in a daisy-chained configuration, and unique programming features of each ISP device, see the Lattice Semiconductor *ISP Encyclopedia*.

Downloading Using ispDCD

Daisy chain downloading consists of the following general steps:

1. Invoking the Lattice ISP Daisy Chain Download software
2. Creating a chain configuration
3. Verifying the chain configuration
4. Performing operations on the chain

Invoking the ispDCD Tool

To invoke the ispDCD tool:

From the Windows desktop, select **Start** ⇒ **Programs** ⇒ **Lattice Semiconductor** ⇒ **ispDCD**.

When you invoke the ispDCD download program, the ISP Daisy Chain Download window appears (Figure 3-1).The software first scans to determine if there is a download cable connected to the board. If an ispDOWNLOAD cable is not attached, an alert appears in the Messages window.

Figure 3-1. ISP Daisy Chain Download Window

Configuration Files

Configuration files contain information about the device chain, such as: the index number of each device as it appears in the chain, the ISP device type, the design file you wish to download to each specific device, and the operation(s) that you wish to perform on each device.

Configuration File Format

Using the ispDCD tool, configuration files are saved in the download data (.dld) format. You can either create a new configuration setup (.dld) file or load an existing one. To create a new configuration file, follow the procedure below for the different chain types. To load an existing configuration, refer to **"Opening an Existing Chain Configuration" on page 46**.

Creating a New Chain Configuration

Using the ispDCD tool, you can create chain configuration files for the following three types of download chain configurations:

- ISP chain or an ispJTAG chain using ispLSI devices
- ispJTAG chain with ispLSI devices and non-LSC JTAG devices
- Mixed ISP and ispJTAG chain

If the target hardware is connected to your PC (for example, using the isp Engineering Kit Model 100), the easiest way to create a configuration is to first scan the chain. The software identifies all ISP and JTAG devices available for programming, regardless of how they are ported or mounted, and lists device order and type.

To automatically detect a configuration by scanning the chain, perform step 1.
To create a configuration manually without scanning it, skip step 1 and proceed to step 2.

To automatically detect a chain configuration:

1. If the target hardware is connected to your PC or the isp Engineering Kit Model 100, select **Configuration** ⇒ **Scan Board** for ISP chains, or **Configuration** ⇒ **Scan Mixed Chain** for mixed ISP/ispJTAG chains, or click the related icons.

   If more than 200 devices are connected to the board, an alert appears in the Messages window. Otherwise, the Scan Board Configuration Setup window appears (Figure 3-2).

   A basic configuration file now exists that contains all devices in the chain, but you must still specify what JEDEC files to use and what operations to perform. If you use this scan method, you can now skip ahead to step 8 on page 45. Otherwise, go to step 2 on the next page.

ispJTAG Chain with ispLSI Devices and non-LSC JTAG Device Chains

The method used for ispJTAG chains containing ispLSI devices and non-LSC JTAG devices is the same as that used for chains containing only ispLSI devices. However, if the non-LSC JTAG devices contain a non-JTAG compliant capture-IR pattern, the scan will fail. If this is the case, simply follow the procedure beginning with step 2.

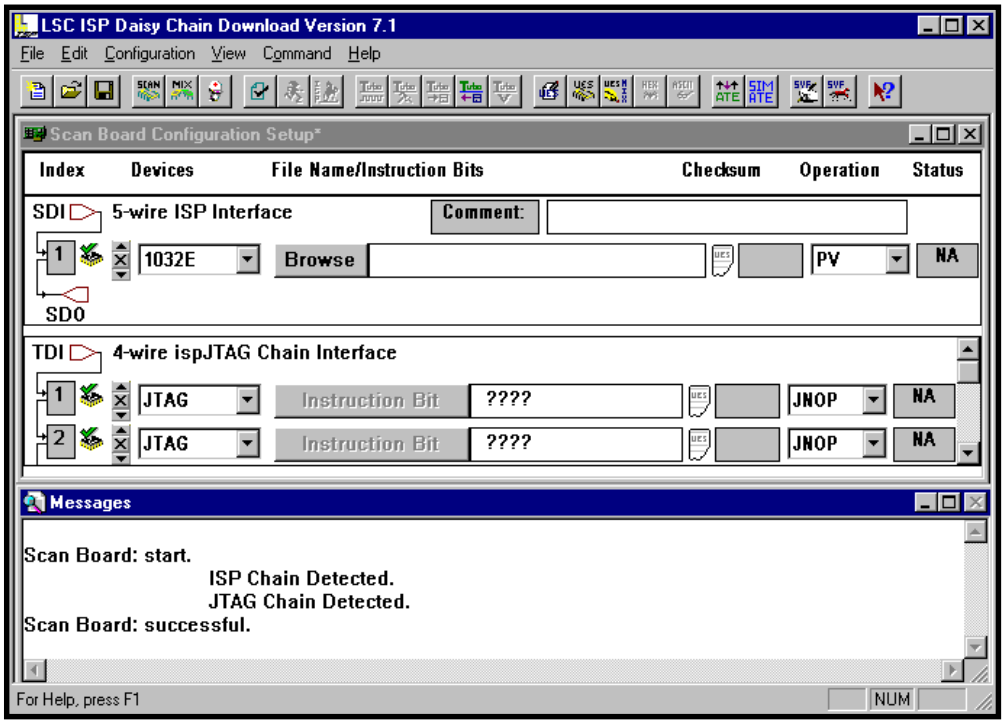

Figure 3-2. Scan Board Configuration Setup Window (Mixed Chain)

To create a chain configuration without scanning:

2. Select **File** ⇒ **New** or click the **New Configuration Setup File** icon from the ISP Daisy Chain Download menu. The New Configuration dialog box appears (Figure 3-3). For mixed chains, an additional section, ispJTAG Information, is added to the lower portion of the New Configuration dialog box (Figure 3-4).

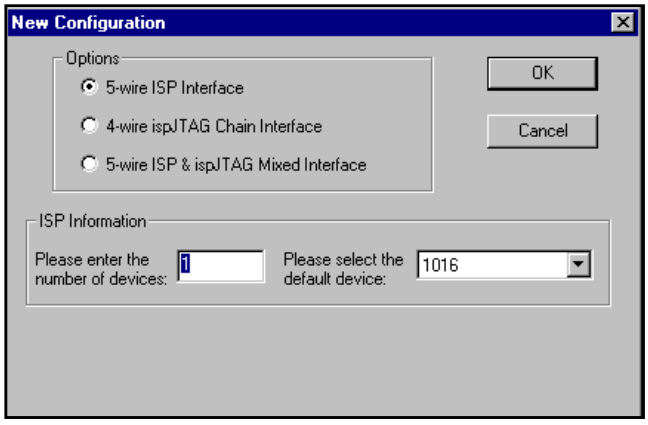

Figure 3-3. New Configuration Dialog Box

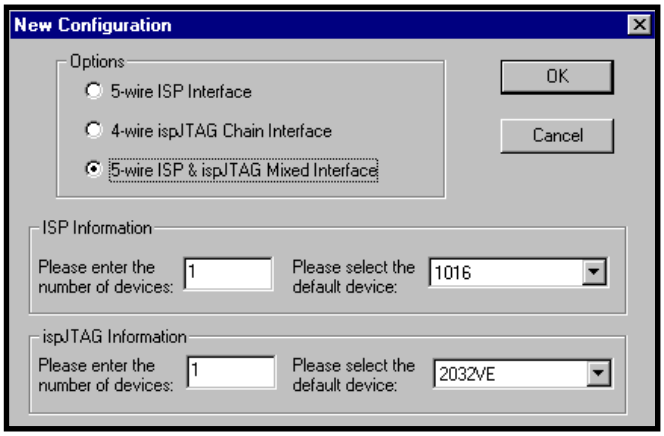

Figure 3-4. New Configuration Dialog Box (Mixed Chains)

3. In the Options area of the New Configuration dialog box, select the desired interface option.
4. In the ISP Information area of the New Configuration dialog box, enter the number of ISP devices that you want to program in the range of 1 (the default value) to 200 (the maximum value). For mixed chains, also enter the number of ispJTAG devices in the ispJTAG Information area of the New Configuration dialog box.

> ***NOTE*** If you use the download cable (part number pDS4102-DL), Lattice recommends that you configure no more than eight ISP devices in a daisy chain. Otherwise, we recommend a buffer for every SCLK/TCK and MODE/TMS signal.

5. In the ISP Information section of the New Configuration dialog box, select an ISP device type from the default device pull-down list. For mixed chains, also select a device type from the default device pull-down list in the ispJTAG Information section of the dialog box. If you do not select a device, the ISP/ispJTAG device will be set according to the default device (Table 3-1).

Table 3-1. Default Devices

Chain Option	Default Device
5-wire ISP interface	ispLSI1016E
4-wire ispJTAG Chain	ispLSI2032VE
5-wire ISP & ispJTAG Mixed Interface	ispLSI1016E & ispLSI2032VE

6. Click **OK**. The New Configuration Setup window appears (Figure 3-5). New Configuration Setup options are listed and described in Table 3-2.

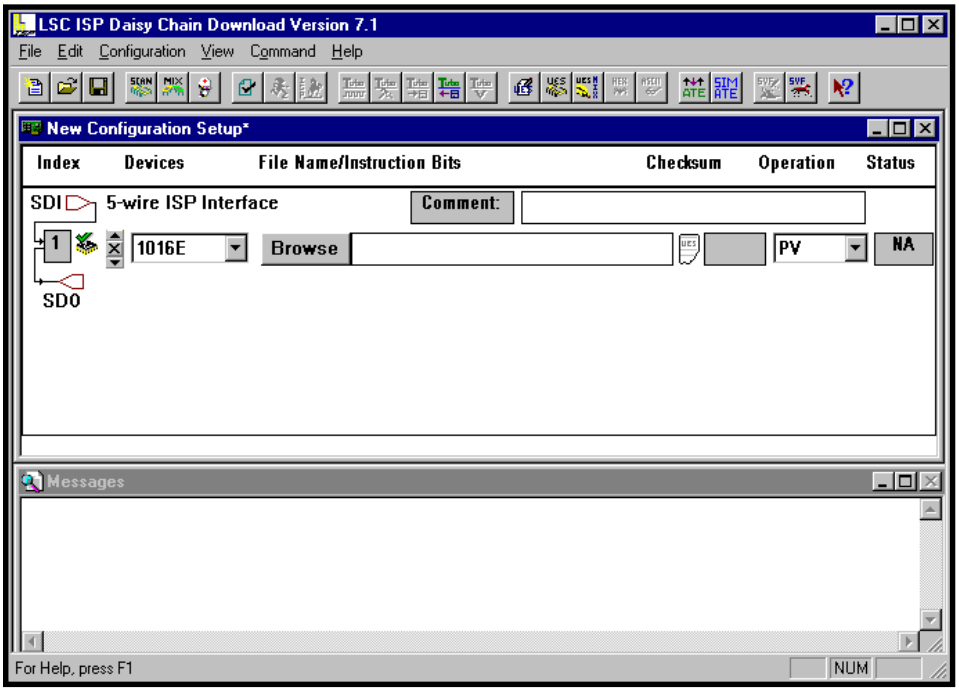

Figure 3-5. New Configuration Setup Window

Table 3-2. New Configuration Setup Options

Options/ Features	**Description**
Comment Box	Allows you to enter a comment of up to 256 characters about the .dld file.
Index Number	Lists the order of the identified devices; this column is not editable.
Devices	Use the pull-down list to select the following device types when creating a configuration: JTAG – Denotes non-LSC JTAG-compatible devices SVF – Denotes an SVF vector file is available for the device BSDL – Denotes a BSDL file is available for the device
File Name/ Instruction Bits	Displays the file name (.jed) and the instruction register bit length of the JTAG device. An “all 1s” instruction is sent to non-LSC JTAG devices to put them in bypass mode on all operations. Enter the file name in the field or choose **Browse** to locate a file.
Checksum	The checksum of the given JEDEC file is read and displayed.

Table 3-2. New Configuration Setup Options (Continued)

Options/ Features	**Description**
Operation	Lists the operation mode for each file; the default is Program & Verify. Operation modes include those listed below. **NOTE:** Some modes of operation are only available for specific configurations. PV (Program & Verify) – Performs a download of the design pattern, then verifies the chip program (device pattern) with the original .jed file to ensure the device was programmed correctly. The file name must be specified. PVS (Program, Verify & Secure) – Performs a download of the design pattern, verifies the chip program (device pattern) with the original .jed file, and sets the security bit so that the device cannot be read. V (Verify) – Compares the chip program (device pattern) with the specified .jed file. C (Checksum) – Computes the check sum value of the chip and sends the information to the Status field for the corresponding device. RS (Read & Save) – Reads the chip program and writes it to the specified JEDEC file. E (Erase) – Erases the chip program and the security fuse for the device you specify. NOP (No Operation) – Indicates that no operation will be performed for that device. JPV (JTAG Program & Verify) – Performs a download of the design pattern, then verifies the chip program (device pattern) with the original .jed file to ensure the JTAG device was programmed correctly. A file name must be specified. JPVS (JTAG Program, Verify & Secure) – Performs a download of the design pattern, verifies the chip program (JTAG device pattern) with the original .jed file, and sets the security bit so that the device cannot be read. JV (JTAG Verify) – Compares the chip program (device pattern) with the specified JTAG file. JRS (JTAG Read & Save) – Reads the chip program and writes it into the specified JTAG file. The file name must be specified. If the file name already exists, a dialog box appears asking if you want to replace the existing file. JE (JTAG Erase) – Erases the chip program and the security fuse for the specified JTAG device. JNOP (JTAG No Operation) – Indicates that no operation will be performed for that JTAG device. The device is set to bypass mode. **NOTE:** JNOP is the only available option for a non-LSC JTAG device.

Table 3-2. New Configuration Setup Options (Continued)

Options/ Features	**Description**
Status	Shows the success factor after running a download procedure; the default is NA until the ispDCD software for the configuration setup is executed. Status results include the following: Pass Fail Hexadecimal Value Done NA (not applicable). The JTAG devices will remain NA throughout your download procedure.

7. In the New Configuration Setup window, select the device type from the Devices field pull-down list for each device in the chain.
8. Enter the JEDEC design file name or select **Browse** to find a file. If you choose browse, the Browse JEDEC File dialog box appears (Figure 3-6). Locate your file and choose **Open**. The Browse dialog box closes and the .jed file name that you chose appears in the Configuration Setup dialog box for that device.
9. Select the mode of operation from the Operation pull-down list.

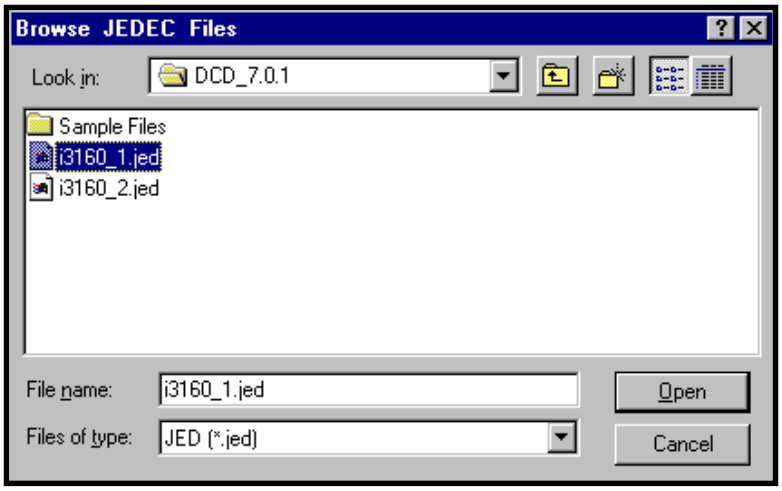

Figure 3-6. Browse JEDEC Files Dialog Box

Opening an Existing Chain Configuration

To open a chain configuration:

1. Select **File** ⇒ **Open** or click the **Open Configuration Setup File** icon in the ispDCD menu. The Open File dialog box appears and the Files of type field defaults to DLD (*.dld).
2. Select the desired configuration (.dld) file.
3. Click **Open** to execute or click **Cancel** to close the dialog box.

Verifying a Chain Configuration

Once you have created (or opened) a configuration file and specified the configuration parameters for each device in the chain, you can verify that the configuration file is valid before performing operations on the chain.

To verify a chain configuration:

Select **Command** ⇒ **Check Configuration Setup** or select the **Check Configuration Setup** icon.

The software performs a configuration check and displays the results in the Messages window. Once your configuration is verified, you can save the configuration and perform operations on the chain.

Saving a Chain Configuration

Once you have set all configuration parameters and verified it as valid, you can save your configuration.

To save a chain configuration:

1. Select **File** ⇒ **Save As** from the menu bar or click the **Save Configuration Setup** icon from the ISP Daisy Chain Download toolbar. The Save As .DLD dialog box appears.
2. Type the name of your design file in the File name field. The file extension defaults to .dld, so you need only enter the file name itself. However, if you enter more than eight characters, the file name is truncated. The full name of a file is not recognized against the truncated file name so the truncated file name overwrites itself each time you perform a save.
3. Use the Save in pull-down list to choose the directory into which the configuration file will be saved.
4. Click **Save**. The *name*`.dld` appears in the main ISP window.

Performing Operations on the Chain

To perform the operations you specified on the device(s) in the chain:

Select **Command** ⇒ **Run Operation in Sequential Mode** or click the **Run Operation** icon in the ispDCD menu. The operations specified are performed on each device in sequence.

To program multiple devices quickly, use the turbo download feature. Refer to **"Turbo Downloading – Using ISP Bit Streams" on page 50**.

User Electronic Signature (UES)

The JEDEC file contains User Electronic Signature (UES) data that you can edit or read in from the board. The UES can be set or read using either hexadecimal or ASCII formats.

> ***NOTE*** The transmission checksum is recalculated each time the UES is modified.

Editing a UES

To edit a JEDEC file's UES in hexadecimal format:

1. Select **Command** ⇒ **Edit File UES** ⇒ **Hexadecimal** from the ISP Daisy Chain Download menu or click the **Edit UES File** icon to edit a JEDEC file's UES. The menu command allows you to choose either Hexadecimal or ASCII format, whereas the icon defaults to hexadecimal. The Open .JED File dialog box appears (Figure 3-7).

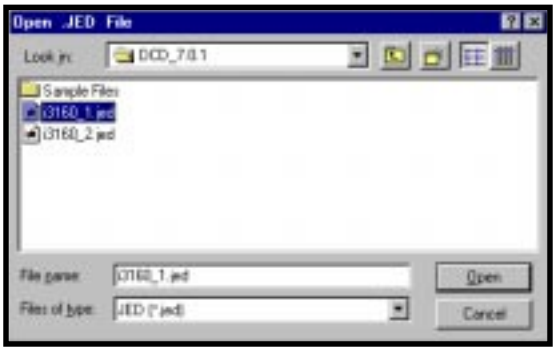

Figure 3-7. Open .JED Dialog Box

2. Select a .jed file. Click **Open**. The UES dialog box appears (Figure 3-8).

You may also choose to edit the UES from the JEDEC file selected for a specific device in the chain. Simply click on the **Edit UES of the JEDEC file** icon adjacent to the file name of that device (Figure 3-9).

3. The default device for the given JEDEC file appears in the Device pull-down list. If the device that you are using is JTAG programmable, the UES is normally only 32 bits long. In this case, use the Device pull-down list to select the JTAG device that matches the correct UES size.

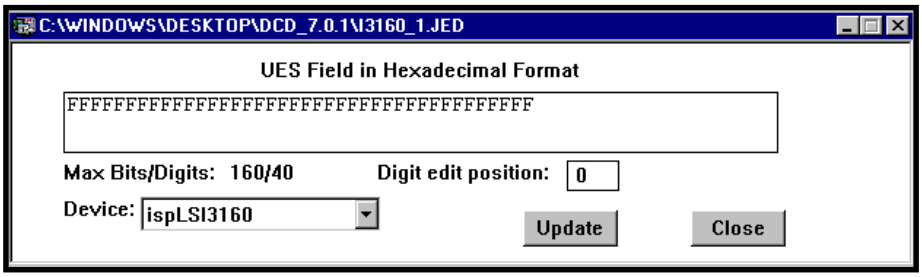

Figure 3-8. JEDEC File with UES Dialog Box

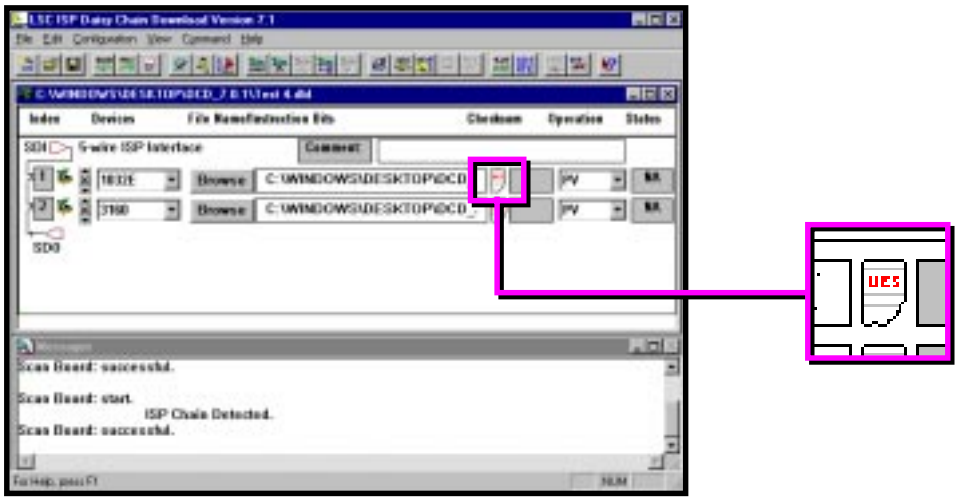

Figure 3-9. Edit UES Icon for a Specific JEDEC File

4. Type in the signature using only hexadecimal characters (0-9 and A-F). The Digit edit position field displays the current bit position as you type. After entering the UES, click **Update**.
5. The UES Write Successful dialog box appears telling you the signature was saved in the .jed file.

> ***NOTE*** Remember, the UES is embedded on the device only after you perform a download.

If you select the **Close** button before you select **Update**, the dialog box closes and the new signature is not saved to the .jed file.

To edit a UES in ASCII format:

Editing a UES in ASCII format works in similar fashion; however, in ASCII format, you are allowed to enter any printable character – with the exception of control characters. The default ASCII signature for a file is ..... (the dot character).

Scanning the Board for the UES

You can scan the chain for the UES values of all the devices in an ISP chain or an ispJTAG chain, or all the ispJTAG devices in a mixed ISP/ispJTAG chain.

To read the UES values from an ISP or ispJTAG chain:

1. Select **Command** ⇒ **Display Board UES** ⇒ **Hexadecimal** or the **Display Single Chain UES** icon from the ISP Daisy Chain Download menu. The UES in Hexadecimal (Figure 3-10) or UES in ASCII window appears. The icon defaults to hexadecimal format, but by using the pull-down menu command, you may also select the **ASCII** option. Check the Messages window to confirm that the scan function of the devices was successful.

To read the UES values from a mixed ISP/ispJTAG chain:

If your board has a mixed chain, select the **Command** ⇒ **Display Mixed Chain UES** menu option or the Display Mixed Chain UES icon to display the UES of the JTAG chain. You may select either ASCII or Hexadecimal format.

Figure 3-10. UES in Hexadecimal Window

You cannot edit the signatures on the devices in this dialog box. This command only allows you to view the signature and comment that you have already downloaded onto the devices. If you have not downloaded a personal signature onto your devices, the *default* signature data will appear in the signature field.

> **NOTE** The default signature for low-density devices is 0. The default signature for high-density devices is F in hexadecimal format.

For additional information on UES, refer to *User Electronic Signature*. This document is available from the following sources:

- The Lattice Semiconductor Literature Department (1-800-327-8425)
- The Lattice Semiconductor world wide web site (http://www.latticesemi.com)

Turbo Downloading – Using ISP Bit Streams

Turbo downloading differs from the **Run Operation** command in the way the ISP bit stream is read from the JEDEC files and sent to the daisy chain. Turbo downloading programs multiple devices in a parallel fashion, rather than sequentially. This saves a significant amount of time with a large number of devices; in fact, the more devices that are chained together, the more time you save.
Another advantage of turbo downloading is that you can save your ISP bit stream and reuse it for downloading to the same device configuration.

Building a Bit Stream

To build a bit stream:

1. Create or load a configuration. Ensure that you have selected .jed files for each device and the file names are displayed in the File Name/Instruction Bits field of the configuration window.
2.

Select **Command** ⇒ **Turbo Download** ⇒ **Build** or click on the **Build Turbo Download** icon from the ispDCD window toolbar.

The process builds the ISP bit stream and stores it in a temporary buffer. Check the messages window for important information. When the bit stream has been successfully completed, the Messages window will display the following message:

```
Building ISP Chain:
            Operation is done. No error.
End: Turbo Download->Build.
```

Saving a Bit Stream

After building an ISP bit stream, you can save it as an .isp file for later use.

To save a bit stream:

1. Select **Command** ⇒ **Turbo Download** ⇒ **Save ISP File** or click on the **Save ISP File** icon from the ispDCD window toolbar. The Save as .ISP File dialog box appears (Figure 3-11).

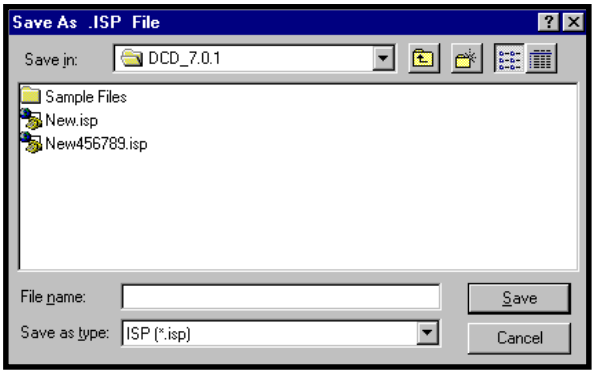

Figure 3-11. Save as .ISP Dialog Box

2. Enter the name of the new .isp file and select the destination.
3. Click on **Save** to save the file as an .isp file (the .isp extension will be added automatically by the system).

Loading an Existing Bit Stream

If you previously saved an ISP bit stream, you can reuse it; you do not need to rebuild the ISP bit stream for the same device configuration. This function retrieves a named .isp file and loads it into the buffer for downloading.

To load an ISP bit stream:

1. Select **Command** ⇒ **Turbo Download** ⇒ **Load ISP File** or select the **Load ISP File** icon from the ISP Daisy Chain Download menu. The Open .ISP File dialog box appears.
2. Type in the name of your design file in the **File Name** field. All .isp files in the current directory are displayed. If the ISP bit stream file you desire does not have an .isp extension, the file will not appear in the Field name list. In that case, select ALL (*.*) in the “Files of type” field.
3. Click **Open** to load the ISP bit stream file. The *name*`.isp` appears in the configuration setup window. The ISP bit stream file is loaded into the buffer and reconstructs the configuration setup window. You can now download the file.

   You may also click **Cancel** to close the Open .ISP File dialog box.
4. Check the Messages window to verify that the bit stream has been loaded successfully.

Verifying a Bit Stream

When you verify an ISP bit stream, the software checks the stream against the devices to verify that the .dld file (configuration setup) is present and accurate. The **Turbo Download** ⇒ **Verify** option processes only the verify section of the ISP bit stream; the erase and program section is unconditionally bypassed.

To verify the ISP bit stream:

1. If an ISP bit stream is not loaded, load or build an .isp file.
2. Select **Command** ⇒ **Turbo Download** ⇒ **Verify** or click on the **Verify Turbo Download** icon.
3. Check the Messages window. It should list each device by index number, type, and state that the configuration setup check was successful.

Downloading a Bit Stream

Once the ISP bit stream has been verified, you may download the bit stream by selecting **Command** ⇒**Turbo Download** ⇒ **Run Turbo Download** or clicking on the **Run Turbo Download** icon.

The system checks the configuration setup file and then downloads the ISP bit stream file to the devices. The Messages window displays the process and results.

Using ATE

The ispATE option can be used to convert one or more JEDEC files to the ATE-specific vector format. The ATE then applies these vectors to the ISP interface pins to program or verify the ISP devices as part of the board test program.

In addition, the ispATE option supports the Lattice Daisy Chain programming configuration, which allows one or more ISP devices to be turbo-programmed in a serial chain through a single set of ISP programming signals. The ispATE option can also create vectors in JEDEC format (ispVECTOR), which allows you to convert to ATE format.

Using ATE Vectors

You can use automatic test equipment (ATE) to program and verify ISP devices, instead of using stand-alone device programmers. Because you can customize your ISP device configurations specifically for board-level testing, you can enhance the testability of your product.

Any ATE programming solution requires a JEDEC file and a method to translate the JEDEC file into signals on the ISP interface driven by the ATE. The following options are available for performing this translation:

- Create ATE-specific test vectors to program the devices using a translation tool from Lattice Semiconductor
- Compile the programming vectors to an ATE program using the compiler provided by the ATE vendor

This section discusses how to create programming test vectors. For additional information on configuring ATE with Lattice Semiconductor software and devices, refer to the *ispATE Software Data Sheet*. This document is available on the Lattice Semiconductor world wide web site (http://www.latticesemi.com).

> ***NOTE*** Only Turbo programming is supported by ATE test vendors.

To generate ATE vectors:

Select **Command** ⇒ **Generate ATE Vectors** or the **Generate ATE Vectors** icon from the ISP Daisy Chain Download menu bar. The ATE Vector File Options dialog box appears (Figure 3-12).

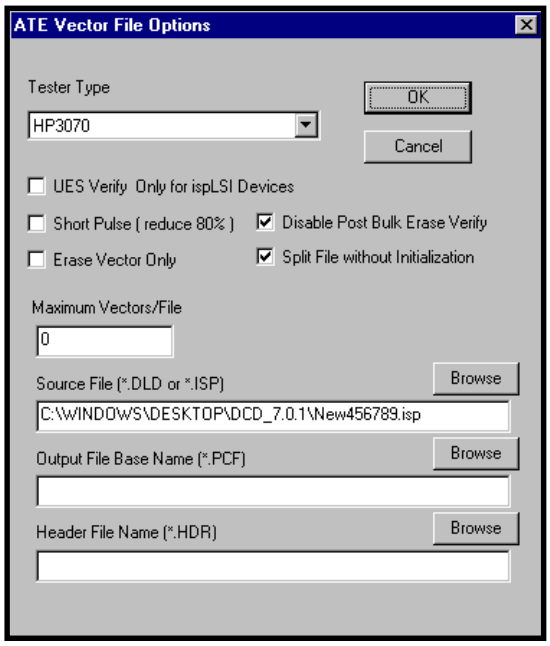

Figure 3-12. ATE Vector File Options Dialog Box

ATE Vector File Option Box fields are described in Table 3-3.

Table 3-3. ATE Vector File Option Box

Option	Description
Tester Type	A pull-down menu with Lattice Semiconductor supported and compatible testers. Note: To specify Marconi as the tester, select ispVECTOR in the pull-down menu.
UES Verify	Verifies the User Electronic Signature data for ispLSI devices.
Short Pulse (reduce 80%)	For temporary test programming, the Short Pulse option is an option that allows you to cut programming time. It is not guaranteed for permanent download to your device.
Erase Vector Only	Erase Vectors can be created by selecting the Erase or JTAG Erase modes of operation in the New Configuration Setup window. You can use this option, if the Programming and Verify or the JTAG Programming and Verify modes of operation are used in the .dld file. The programming and verification vectors are discarded to leave behind only erase vectors and ID check vectors.

Table 3-3. ATE Vector File Option Box (Continued)

Option	**Description**
Disable Post Bulk Erase Verify	This option determines if the post bulk erase verify vectors will be generated in each vector file. By checking this box, fewer vectors are generated and the file sizes are smaller. However, post bulk erase verify vectors help to confirm that the device is erased properly.
Split File without Initialization	This option (for HP ATE testers only) allows the vector files to be split according to size to save vector size. Pull down resistors on ispEN, MODE and SCLK are mandatory to use this option.
Maximum Vectors/File	This option includes the maximum number of vectors allowed in each vector file. This data can be obtained from the ATE vendor. A default setting of 0 builds one ispVECTOR file.
Source File (*.DLD or *.ISP)	This option includes the ISP bit stream file name you will use to create the ATE vector files. This file must be either a configuration setup file (.dld) or an ISP bit stream (.isp) file. If you are unsure of the file name, click **Browse** for a selection.
Output File Base Name (*.PCF) (*.GR) (*.ASC) (*.TST)	This option includes the file name base (six characters or less) that will be appended incrementally by the ATE generation process file format. The file extension depends on the ATE vendor. For example, if you enter “vec” as the base name for the HP 3070 tester, and 128 files are created, the file names will appear as vec0.pcf, vec1.pcf, vec2.pcf, etc.
Header File Name (*.HDR)	This option includes the file name (if the file is located in your current directory) or full path (if the file is located in another directory) for the header data that you type in any text editor file. The header data, in the default .hdr format, can include the author name, the type of configuration setup that this header will appear with, pin definitions, signal names, timing information, etc. The ispDCD software will affix this header data to the head of each ATE vector file it generates. This option is only available for certain testers.

The following steps provide an example of how to complete the ATE Vector File Options dialog box (Figure 3-13).

1. Select the tester type with the Tester Type pull-down menu. This field must be set according to the ATE you are using. Select **HP3070**.
2. Type in a .isp or .dld file name in the Source File field or click **Browse**. The Open .ISP/.DLD File dialog box appears. Once you select a file, the path appears in the Source File field. Type **`ate2.isp`** or **`ate2.dld`.**
3. Enter a number in the Maximum Vectors/File field. Obtain a valid number range from the ATE specifications for whichever tester type you are using. For this example, leave this field at the default value of **`0`**.
4. Enter a file base name in the Output File Base field. Type **`vec`**.
5. Enter a name in the Header File Name field (This field is only required by Teradyne and Hewlett Packard tester types). Type **`HP3070.HDR`.**
6. Click the check box to disable the post bulk erase verify feature (this feature is turned on by default).
7. Click the check box to disable the split file feature (this feature is turned on by default).
8. Click **OK**. Check the Messages window for a successful notice and to determine how many files were generated.

▲ CAUTION	**To ensure permanent download, do not use the Short Pulse option when programming the final pattern onto your devices.**

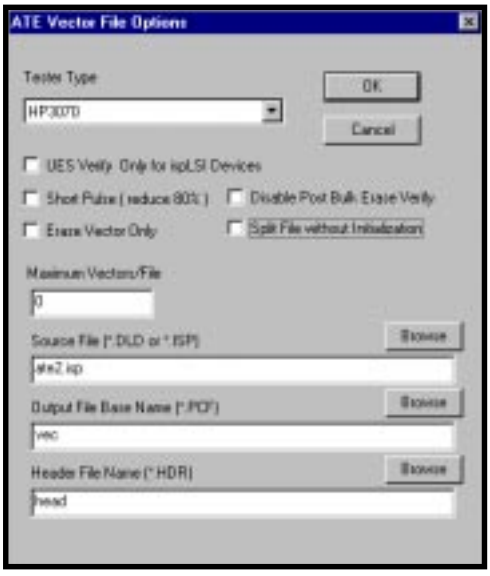

Figure 3-13. Filling in the ATE Vector File Options Dialog Box

You can open and edit the vector files using any text editor. The vector files include markers that identify the beginning of each device and the end of the chain. These

help to isolate pins for troubleshooting. The dot extensions for vector files are determined by the tester type that you select.

Simulating ATE Functions

Using your PC, you can simulate ATE functions. Using a parallel port, the simulation downloads the vectors from the ispVECTOR files to your devices. By simulating the test vector files, you ensure that the test vector files will program correctly.

To simulate ATE vectors:

1. Select **Command** ⇒ **Simulate ATE Testing** or click on the **Simulate ATE Testing** icon from the ISP Daisy Chain Download menu. The ATE Download Simulation dialog box appears (Figure 3-14).
2. Select a file type from the Type Of ATE File pull-down list.
3. Click to disable the Find Time Only option.
4. Enter the base file name in the Base File Name Of ATE File field.
5. Specify the number of files in the Number Of Files field (unlimited).
6. Click **OK**. Check the Messages window for verification of successful completion of the process.

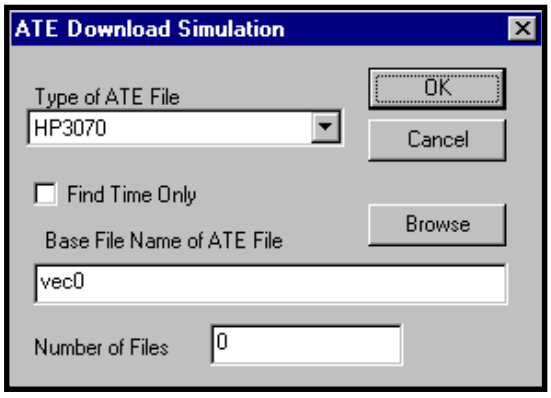

Figure 3-14. ATE Download Simulation Dialog Box

ATE Download Simulation dialog box fields are described in Table 3-4.

Table 3-4. ATE Download Simulation Dialog Box

Option	Description
Type Of ATE File	Specifies the type of ATE vector file to simulate. Lattice Semiconductor supports the ispVECTOR (.tst) file type as well as several third-party testers.
Find Time Only	Calculates the time that the downloading process will take. When this option is used, full simulation will not take place

Table 3-4. ATE Download Simulation Dialog Box (Continued)

Option	Description
Base File Name Of ATE File	Includes the base file name of the vector files you want to simulate. Enter a name that is six characters or fewer. The ispDCD software assumes your vector file is located in your current working directory. Type in the same base file name that you used in the Output File Base field (**vec**).
Number Of Files	Specifies the number of files into which the ispVECTOR file is split. There is no limit to the number of files that can be specified. The number of files is determined during the **Command** ⇒ **Generate ATE** function. The Messages window displays the number of files.

Generating SVF Files

The ispSVF option can be used to convert one or more JEDEC files to the industry standard SVF file format. BSCAN tools, such as Asset InterTek, Goepel, and JTAG technology, can be used to apply SVF vectors to Test Access Port (TAP) pins for programming or verifying ISP devices as a part of the BSCAN test. The ispDCD software allows you to build one of the following two types of SVF files:

- Single Device SVF files
- Turbo SVF Files

Building Single-Device SVF Files

Use the following steps to create a single device SVF file:

1. Select **Command** ⇒ **Generate SVF Files** or click on the **Generate SVF File** icon. The Build SVF File dialog box appears (Figure 3-15). In the Options area, choose Build SVF file for single device and note the following:
   - The source file **Browse** button and edit field are deactivated, preventing you from changing the DLD file name.
   - The Device Information fields are activated, allowing you to choose any single device in the chain. If a foreign device is chosen, that device will be ignored.

Figure 3-15. Build SVF File Dialog Box (Single-Device SVF File)

2. Enter the index number for the device in the chain for which you want to generate the SVF file.
3. Enter a JEDEC file name or use **Browse** to specify the JEDEC file that you wish to use to build the SVF file.
4. Enter a name for the new SVF file in the Save SVF File As field or use **Browse**. You can change the SVF file name or the destination of the SVF file.
5. Click **OK**. The SVF file is generated; watch the Messages window for verification of successful completion of the process.

Building Turbo SVF Files

Selecting this option allows you to create a turbo SVF file for all devices in the chain. Use the following steps to create a turbo SVF file:

1. Select **Command** ⇒ **Generate SVF Files** or click on the **Build SVF File** icon. The Build SVF File dialog box appears (Figure 3-16). In the Options area, choose Build turbo SVF file and note the following:
   - Device information fields are deactivated.
   - You can use the configuration setup file (.dld or .isp) in the New Configuration Setup window to create the Turbo SVF file or change the configuration setup file in the Source File box.
2. If desired, enter a new JEDEC file name to replace the file name already displayed, or use **Browse** to specify a new JEDEC file from which to generate the turbo SVF file.
3. Enter a name for the new SVF file in the Save SVF File As field or use **Browse**. You can change the SVF file name or the destination of the SVF file.
4. Click **OK**. The turbo SVF file is generated; watch the Messages window for verification of successful completion of the process.

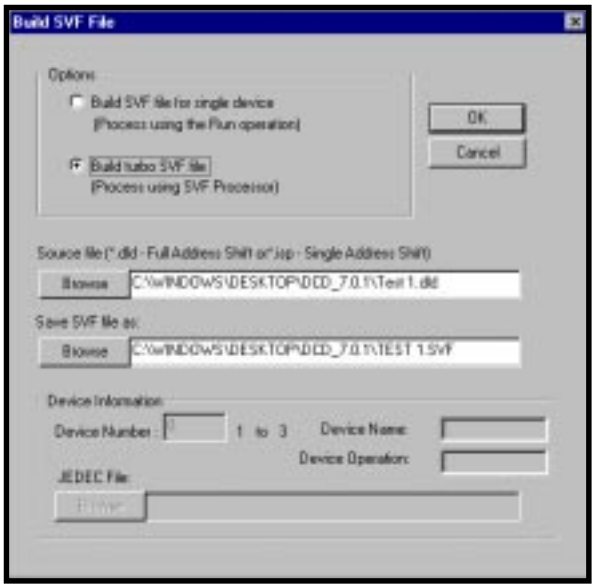

Figure 3-16. Build SVF File Dialog Box (Turbo SVF File)

Processing SVF Files

There are two methods of processing SVF files.

- Processing single SVF files
- Processing Turbo SVF files

Processing a Single SVF File

To process a single SVF file in a daisy chain of ispJTAG devices:

1. Open a new or existing configuration (.dld file) setup.
2. Select **SVF** devices in the Devices pull-down list for the device.
3. Enter the SVF file name or select **Browse** to find a previously generated, single-device SVF file.

4. Select **Command** ⇒ **Turbo Download** ⇒ **Run Turbo Download** or click on the **Run Operation** icon.

Processing a Turbo SVF File

To process a Turbo SVF file for all devices in an ispJTAG daisy chain:

1. Select **Command** ⇒ **Process SVF** or click on the **Process SVF file** icon. The SVF Processor dialog box appears (Figure 3-17).
2. If you want to process an SVF file for the JTAG part of the mixed chain configuration, select the Mixed Chain option. When this option is selected, only the JTAG part of the mixed chain is processed.
3. Enter the desired turbo SVF file name or select **Browse** to find a previously generated turbo SVF file that you wish to process.
4. Click **OK.**

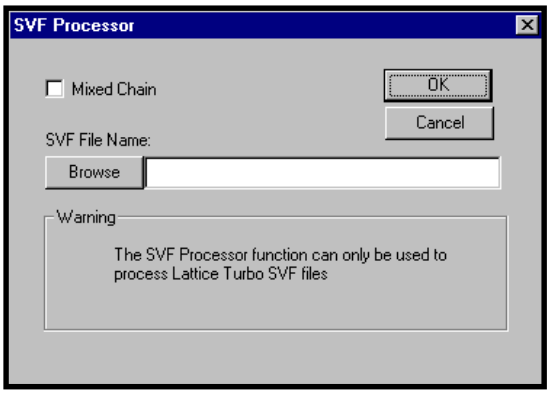

Figure 3-17. SVF Processor Dialog Box

Changing the Port

When you launch the ispDCD software with the cables properly connected, the software identifies the first port it detects. The Port Assignment menu option allows you to change the port setup to accommodate your port requirements.

To change the port setup:

1. Select **Configuration** ⇒ **Port Assignment** from the ispDCD menu. The Port Assignment dialog box appears (Figure 3-18).

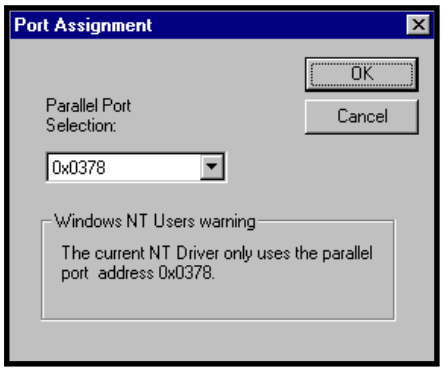

Figure 3-18. Port Assignment Dialog Box

2. Select a port from the Parallel Port Selection pull-down list. Ensure that your port choice is highlighted.
3. Click **OK** to execute your change. If the download cable is not connected or cannot be detected, an error message is displayed in the Messages window.

Downloading Using ispVM

Daisy chain downloading consists of the following general steps:

1. Invoking the required Lattice download tool (ispVM)
2. Creating (or opening) a chain configuration
3. Verifying the chain configuration
4. Performing operations on the chain

Invoking the ispVM Tool

To invoke the ispVM tool:

1. Start the ISP Daisy Chain Download software. From the Windows desktop, select **Start** ⇒ **Programs** ⇒ **Lattice Semiconductor** ⇒ **ispDCD**. The ISP Daisy Chain Download window appears.
2. Select ispVM. From the pull-down menu bar, select **View** ⇒ **ispVM** (Figure 3-19). The ispVM window is displayed (Figure 3-20).

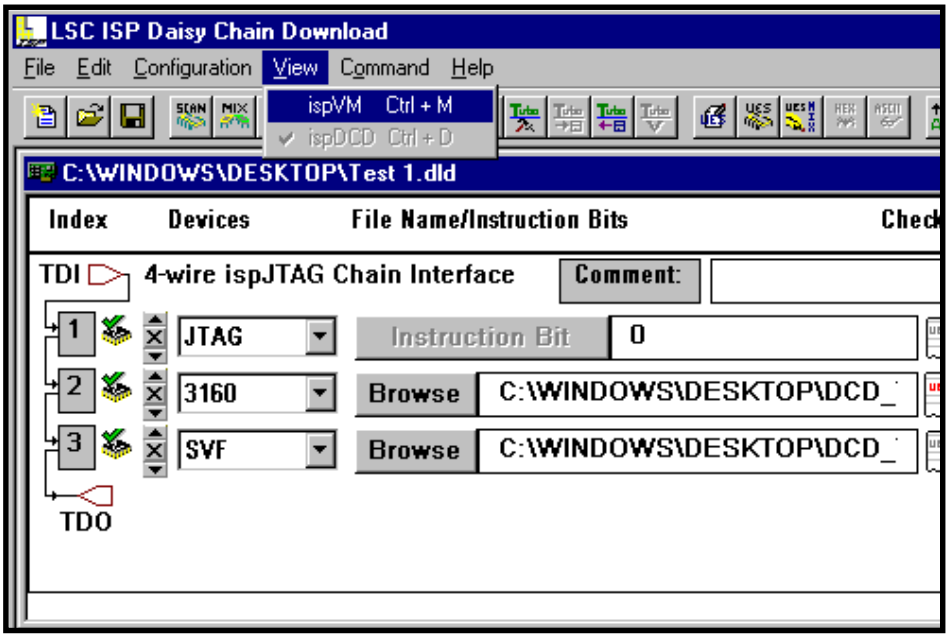

Figure 3-19. Invoking the ispVM Tool

The software first scans to determine if there is a download cable connected to the board. If an ispDOWNLOAD cable is not attached, an alert appears in the Messages window.

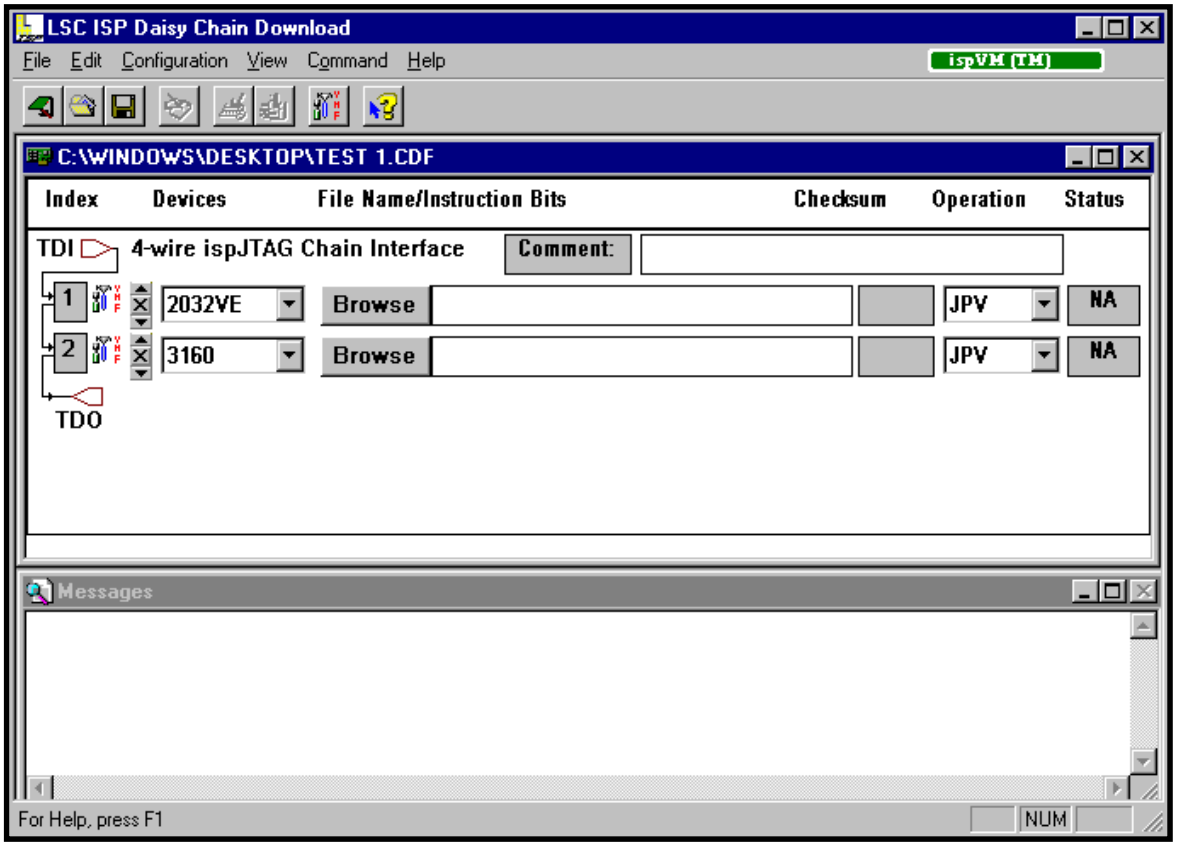

Figure 3-20. ispVM Main Window

Configuration Files

Configuration files contain the index number of each device as it appears in the chain, the ISP device type, the design file you wish to download to each specific device, and the operation(s) that you wish to perform on each device.

Configuration File Format

When using the ispVM tool, configuration files are not saved in the download data (.dld) file format used by the ispDCD tool; instead, configuration files are saved in the configuration download file (.cdf) format.

Creating a New Chain Configuration

You can either create a new chain configuration setup file or load an existing one. To create a new configuration, follow the procedure below. To open an existing configuration, refer to **"Opening an Existing Chain Configuration" on page 69**.

You can use the ispVM to create a new configuration file for the ispJTAG chain with ispLSI devices and non-LSC JTAG devices configuration.

To create a new chain configuration:

1. Select **File** ⇒ **New** or click the **New Configuration Setup File** icon. The New Configuration dialog box appears (Figure 3-21). The 4-wire ispJTAG Chain Interface option is selected.

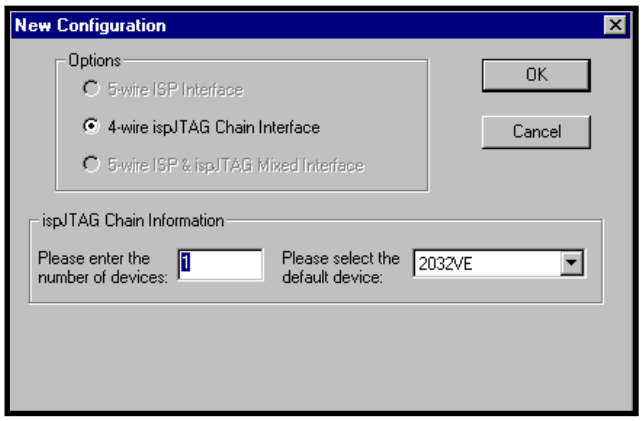

Figure 3-21. New Configuration Dialog Box

2. In the ispJTAG Chain Information area of the dialog box, enter the number of ispJTAG devices that you want to program in the range of 1 (the default value) to 200 (the maximum value).
3. In the ispJTAG Chain Information area of the New Configuration dialog box, select a device type from the default device pull-down menu of the New Configuration dialog box. If you do not select a device, the default device is the ispLSI2032VE.
4. Click **OK**. The New Configuration Setup window appears (Figure 3-22). New Configuration Setup options are listed and described in Table 3-5.

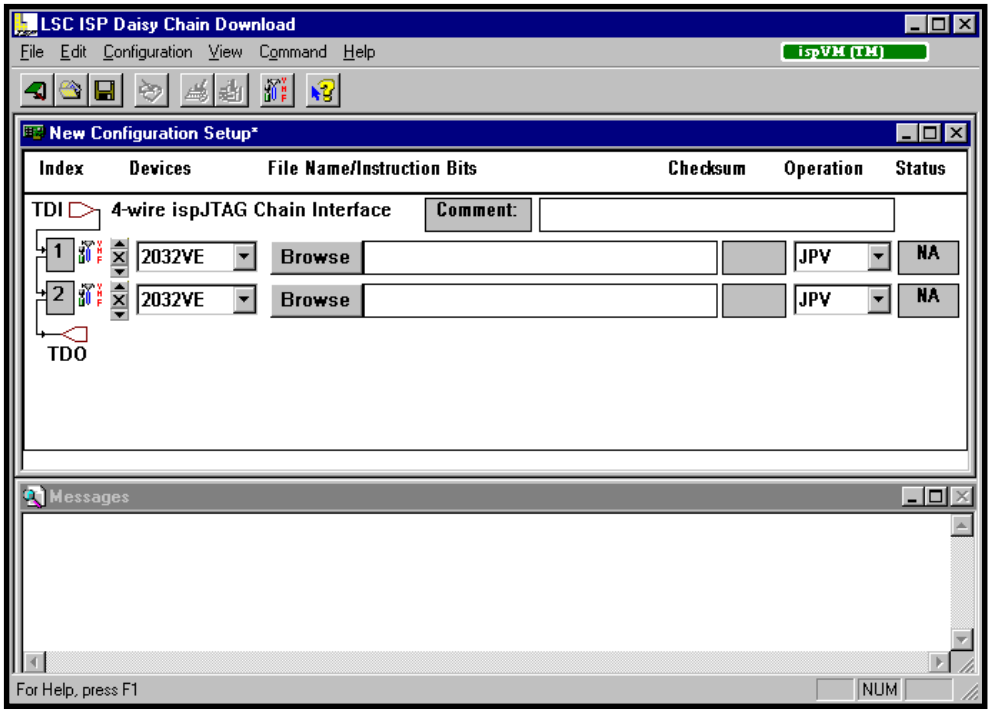

Figure 3-22. New Configuration Setup Window

5. In the New Configuration Setup window, select the device type from the **Devices** field pull-down menu for each device in the chain.
6. Enter the design file name or select **Browse** in the File Name/Instruction Bits field to find a VMF file. If you choose **Browse**, the Browse VMF Files dialog box appears. Locate your file and choose **OK**. The Browse dialog box closes and the .vmf file name that you chose appears in the Configuration Setup dialog box for that device.
   You can also choose to build a VMF file from existing JEDEC or SVF files. For instructions on building VMF files, refer to **"Building VMF Files" on page 72**.
7. Select the mode of operation from the **Operation** pull-down menu.

You can now verify and save the specified download configuration, and use it to program the device chain.

Table 3-5. New Configuration Setup Options

Options/ Features	**Description**
Comment Box	Allows you to enter a comment (up to 256 characters in length) about the .cdf file.
Index Number	Lists the order of the identified devices (not editable).
Devices	Use the pull-down list to select the following device types when creating a configuration: JTAG – Denotes non-LSC JTAG-compatible devices. SVF – Denotes a SVF vector file is available for the device. L-VMF – Denotes a VMF file is available that was built with one or more devices. BSDL – Denotes a BSDL file is available for the non-LSC JTAG device.
File Name/ Instruction Bits	Displays the file name (.vmf) and the instruction register bit length of the JTAG device. An “all 1s” instruction is sent to non-LSC JTAG devices to put them in bypass mode on all operations. Enter the file name in the field or choose **Browse** to locate a file.
Checksum	Displays the checksum of the given VMF file.
Operation	Lists the operation mode for each file (the default is JTAG Program & Verify). Operation modes include those listed below. **NOTE:** Some modes of operation are only available for specific configurations. JPV (JTAG Prog & Ver) – Downloads the design pattern using the specified .vmf file, then verifies the chip program (device pattern) with the original .vmf file to ensure that the JTAG device was programmed correctly. The file name must be specified. JPVS (JTAG Prog, Ver & Secure) – Performs a download of the design pattern, then verifies the chip program (device pattern) with the original .vmf file to ensure that the JTAG device was programmed correctly, and sets the security bit so that the device cannot be read. The file name must be specified. JV (JTAG Verify) – Compares the chip program (device pattern) with the specified .vmf file. JE (JTAG Erase) – Erases the chip program and the security fuse for the JTAG device you specify. JNOP (JTAG No Op) – Indicates that no operation will be performed for that JTAG device. The device will be put in bypass mode. It is the only option for a non-LSC JTAG device.

Table 3-5. New Configuration Setup Options

Options/ Features	**Description**
Comment Box	Allows you to enter a comment (up to 256 characters in length) about the .cdf file.
Status	Shows the success factor after running a download procedure (the default is NA until the ISP Daisy Chain Download software for the configuration setup is executed). Status results include the following: Pass Fail Done NA (not applicable). The JTAG devices will remain NA throughout the download procedure.

Opening an Existing Chain Configuration

To open a configuration:

1. Select **File** ⇒ **Open** or click the **Open Configuration Setup File** icon in the ispVM menu.
2. Select the desired configuration (.cdf) file.
3. Click **OK** to execute or click **Cancel** to close the dialog box.

Verifying a Chain Configuration

Once you have created (or opened) a configuration file and specified the VMF file for each device in the chain, you can verify that the configuration file is valid before performing operations on the chain.

To verify a configuration:

Select **Command** ⇒ **Check Configuration Setup** or select the toolbar **Check Configuration Setup** icon.

The software performs a configuration check and displays the results in the Messages window. Once your configuration is verified, you can save the configuration and perform operations on the chain.

Saving a Chain Configuration

Once you have set all configuration parameters and verified that the configuration is valid, you can save your configuration as a .cdf file. This file can be opened to reprogram the same chain configuration, or modified to program different configurations.

To save a configuration:

1. Select **File** ⇒ **Save As** or click the **Save Configuration Setup File** icon from the ISP Daisy Chain Download menu. The Save As .CDF File dialog box appears.
2. Type in the name of your configuration file in the File name field. You do not need to enter the extension; the .cdf extension will be added automatically. If you enter more than eight characters for the file name, the file name will be truncated. Remember that the full name of a file is not recognized against the truncated file name; therefore, the truncated file name overwrites itself each time you perform a save.
3. Choose the directory to which you wish to save the file; the file type defaults to CDF (*.cdf).
4. Click **OK**. The *name.cdf* appears in the main ispVM window.

Performing Operations on the Chain

Once you have completely set up a chain configuration, you can perform the operations you specified in the setup process on the chain.

To perform the operations you specified on the chain:

Select **Command** ⇒ **Run Operation** in the ispVM pull-down menu bar or click the **Run Operation** icon in the ispVM toolbar.

The chain configuration is verified, the operations specified are performed, and the results are displayed in the Messages window.

Viewing an Operation Report

After performing operations on the device chain, you can view an ASCII text file that summarizes the operations and results.

To view the operation report file:

Select **Edit** ⇒ **View Report** in the ispVM menu bar or click the **View Report File** icon in the ispVM toolbar to display the report (Figure 3-23).

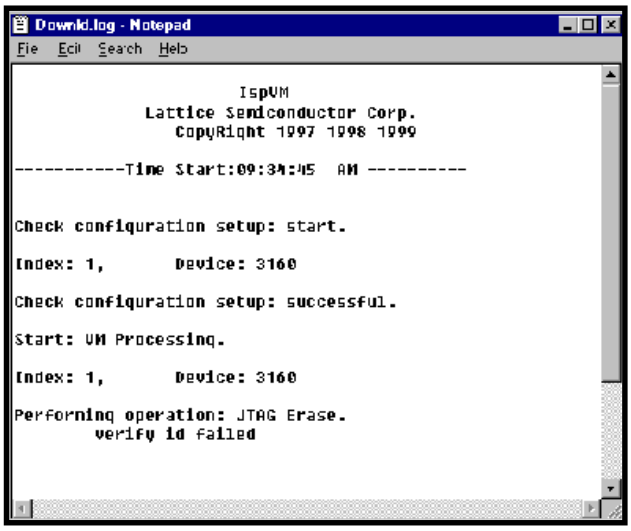

Figure 3-23. Sample Operation Report File

Building VMF Files

When setting up a download configuration using the ispVM tool, you must specify the design file that you wish to download for each device in a chain. You can choose either an existing VMF file for each device, or you can build a VMF file for each device in the chain from existing JEDEC or SVF files.

To build a VMF file:

1. In the New Configuration Setup window, click on the Build VMF File icon (Figure 3-24) for the specific device desired. Alternatively, you may select **Command** ⇒ **Build VMF File**, or click the **Build VMF File** icon from the toolbar. The Build *.VMF Files dialog box appears (Figure 3-25).
2. If you clicked the **Build VMF File** icon for a specific device, the Device Name field and Device Information field values are already displayed for the selected ISP LSC device. Otherwise, use the Device Name pull-down list to select the desired device and display device parameters in the Device Information section of the Build *.VMF Files dialog box.

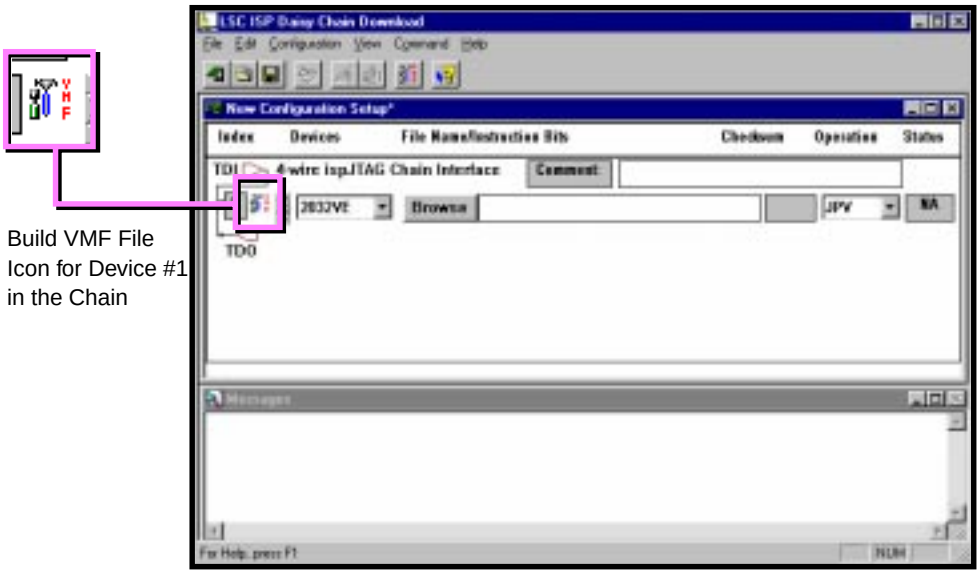

Figure 3-24. Build VMF File Icon for a Specific Device in a Chain

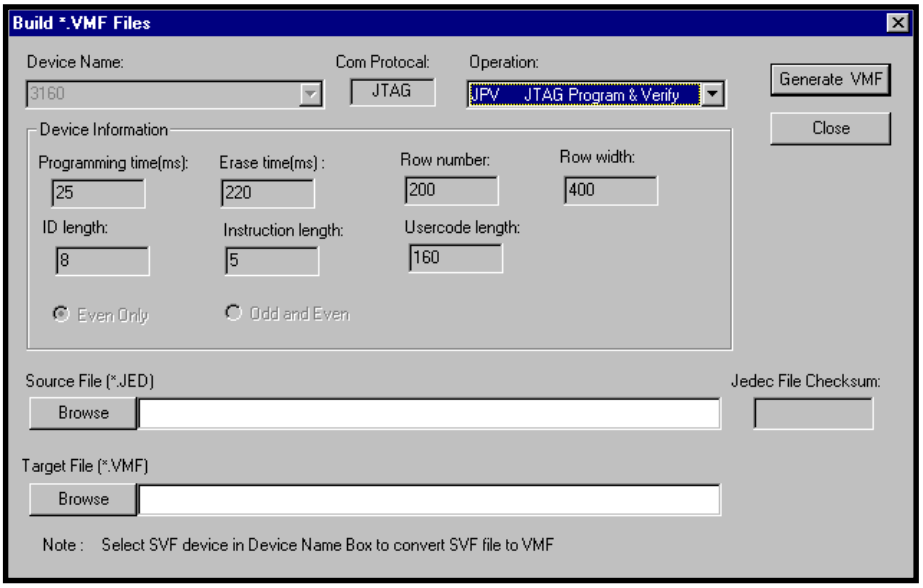

Figure 3-25. Build *.VMF Files Dialog Box

Converting SVF Files

3. If you wish to build a VMF file from an existing SVF file, select SVF for the device name and proceed to the next step. Otherwise, skip to step 12.
4. When you select SVF for the device name, the Device Information section of the Build *.VMF Files dialog box changes to Option (Figure 3-26) and the Source File type defaults to .SVF. Use the Vendor Information pull-down menu to select the device vendor.

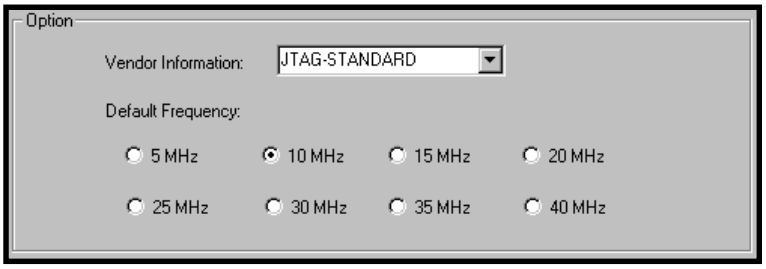

Figure 3-26. Option Section of Build *.VMF Files Dialog Box

5. Select the Default Frequency by clicking the radio button next to the desired frequency.
6. In the lower portion of the Build *.VMF Files dialog box, locate the Source File (*.SVF) field and enter the file name for the desired SVF file. Or, click **Browse** to select the desired .svf file from the Browse SVF Files dialog box.
7. In the Target File (*.VMF) field, the default file name is displayed that consists of the source file name with a .VMF extension. You can accept the default file name, enter a different file name, or click on **Browse** to select the desired .vmf file name from the Save As .VMF File dialog box.
8. Use the Operation pull-down list to select the desired operation for the device.
9. To convert the specified SVF file, click on **Generate VMF**.

10. When a dialog box appears on your screen indicating that the VMF file has been generated, click **OK** to continue.
11. Click **Close** to return to the main ispVM window.

You can now verify and save the specified download configuration, and use it to perform operations, using the specified VMF file(s), on the device chain. Remember, you must specify the desired operation(s) for each device before attempting to run operations.

Converting JEDEC Files

12. If necessary, enter the appropriate values for the parameters in the Device Information section of the Build *.VMF Files Dialog dialog box.
13. In the lower portion of the Build *.VMF Files dialog box, locate the Source File (*.JED) field and enter the file name for the desired JEDEC file. Or click on **Browse** to select the desired .jed file from the Browse JEDEC Files dialog box.
14. In the Target File (*.VMF) field, the default file name is displayed that consists of the source file name with a .VMF extension. You can accept the default file name, enter a different file name, or click on **Browse** to select the desired .vmf file name from the Save As .VMF File dialog box.
15. Use the Operation pull-down menu to select the desired operation for the device.
16. To convert the specified JEDEC file, click on **Generate VMF**.
17. When a dialog box appears on your screen indicating that the VMF file has been generated, click **OK** to continue.
18. Click **Close** to return to the main ispVM window.

You can now verify and save the specified download configuration, and use it to perform operations, using the specified VMF file(s), on the device chain. Remember, you must specify the desired operation(s) for each device before attempting to run operations.

Changing the Port

When you launch the ispDCD software with the cables properly connected, it identifies the first port it detects. This menu option allows you to change the port setup to accommodate your port requirements.

To change the port setup:

1. Select **Configuration** ⇒ **Port Assignment** from the ispVM menu. The Port Assignment dialog box appears (Figure 3-27).

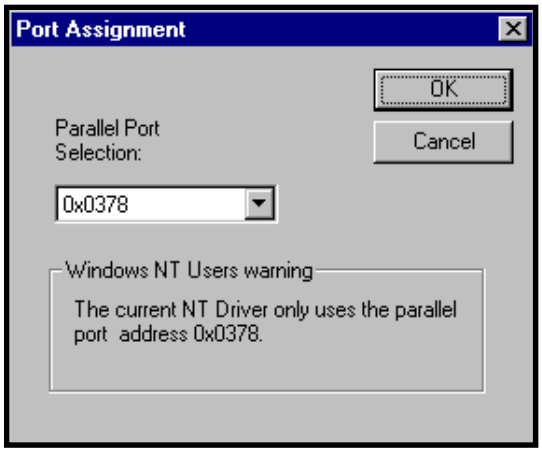

Figure 3-27. Port Assignment Dialog Box

2. Select a port from the Parallel Port Selection pull-down list. Ensure that your choice is highlighted.
3. Click **OK** to execute your changes. If the cable is not connected or cannot be detected (if the board power is not on, for example), an error message is displayed in the Messages window.

Exiting the Program

To quit the ISP Daisy Chain Download software:

1. Select **File** ⇒ **Exit** from the ISP Daisy Chain Download menu. The Save Configuration Setup dialog box appears if you have not saved this file.
2. Click **Yes** to save the changes and exit the ISP Daisy Chain Download program. Click **No** to exit without saving the changes.

   If you created a new configuration and did not name it, the Save As dialog box appears. Enter or select the desired filename and then click **OK** to save the new configuration and exit the ISP Daisy Chain Download software.

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